UNE 24, 1943

The IRON AGE

Ideas for VICTORY
from the Production Lines behind the Firing Lines

A Citation for Men in War Industry

A SIMPLE IDEA...BUT IT STEPPED UP PRODUCTION 40%

In addition to the Victory Pin presented by Warner & Swasey, operator Miller was awarded a war bond by his company, and a citation from W. P. B. He was also given credit, along with other employees who had contributed valuable service to war production, on a national radio broadcast sponsored by The General Motors Corporation.

ONE of the jobs being machined by John Miller, turret lathe operator at the Cadillac Motor Company, is a gear with shaft extension on both sides. As set up, there was not room enough between the spindle and the bar turner in the hex turret to permit square turret operation while the bar turner was cutting. One shaft extension had to be turned before the second could be rough cut and finished.

But John Miller studied the job and found a solution. By pulling more stock out of the spindle and placing cutters in the right side of the square turret, instead of the left side, he was able to combine square turret cuts with hexagon turret cuts, finishing both ends simultaneously, and saving 3 minutes per piece. The rigidity of the hex turret unit on his No. 5 Warner & Swasey made it possible to use this setup, holding .002 accuracy.

Many turret lathe operators have written us, telling how they used the machines and tools at hand to best advantage. Many of these ideas are passed along in Blue Chips, a shop bulletin mailed free to the homes of over 38,000 turret lathe operators. Are your operators getting "Blue Chips"? Just write Warner & Swasey, Cleveland, Ohio.

YOU CAN TURN IT BETTER, FASTER, FOR LESS....
WITH A WARNER & SWASEY

WARNER & SWASEY FOR VICTORY

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This Week in The IRON AGE

Vol. 151, No. 25 — June 24, 1943

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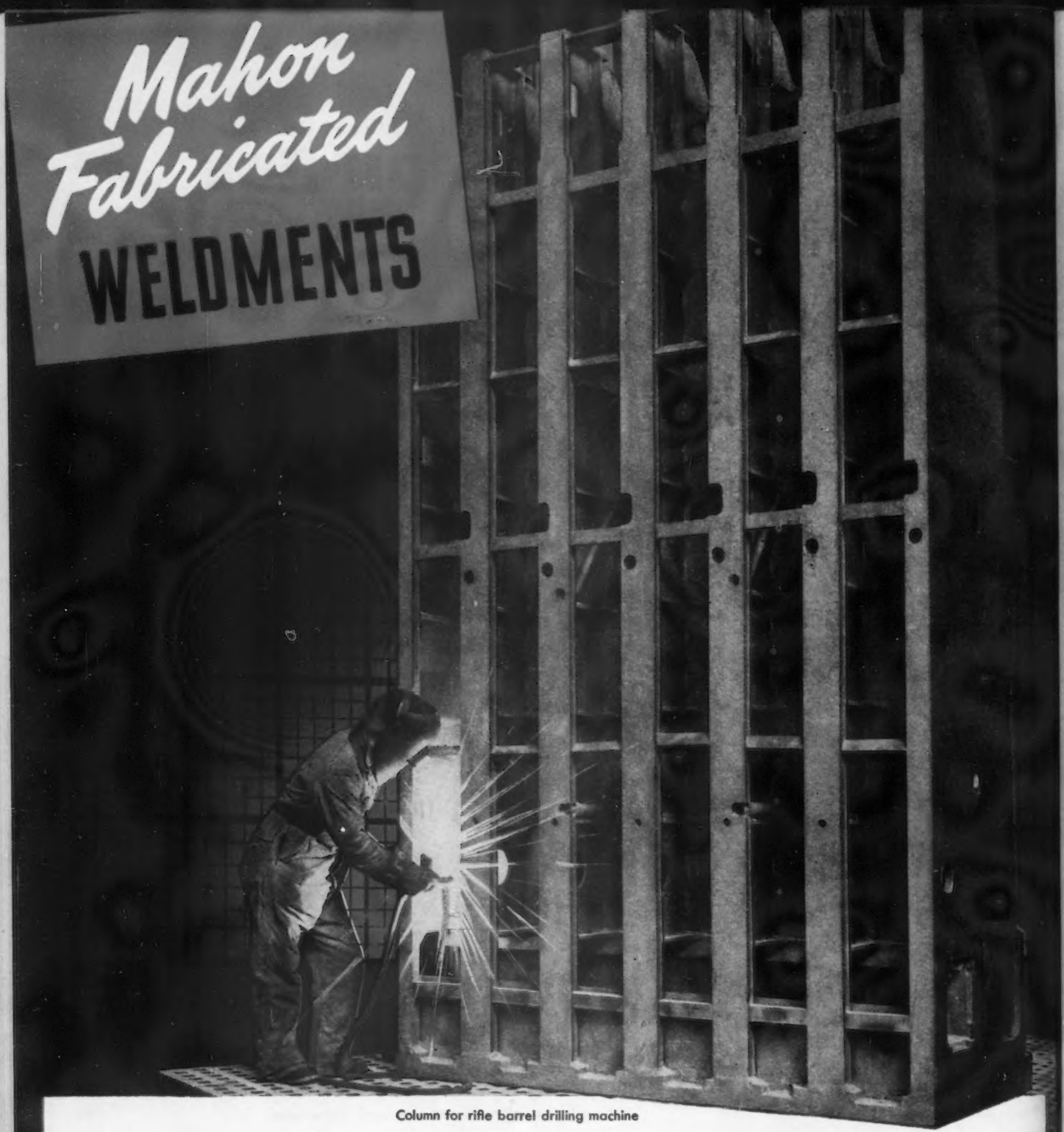
Mahon Fabricated WELDMENTS



Column for rifle barrel drilling machine

New Uses for Steel Plate Fabrication

● War production has opened up a wide range of new uses for welded steel plate fabrication. Manufacturers, in the metal industries, rapidly are recognizing the outstanding advantages of this lighter, stronger, more economical construction. Bases, frames, parts, fittings and assemblies for an ever-increasing number and diversity of products now are being fabricated from steel plate. The scope of applications is virtually unlimited.

In producing the great quantities of weldments, fabricated by Mahon each month, an invaluable fund of information has been acquired. This information is at the disposal of any manufacturer who may be contemplating switching to steel plate fabrication of parts or fittings for his product. In addition, a corps of trained design engineers is available to your engineering staff in working out any problems of design which may occur.

For facts and figures applied directly to your particular product, call in a Mahon representative. A conference will be arranged whenever and wherever you desire. Write—wire—or phone.

THE R. C. MAHON COMPANY

DETROIT CHICAGO

Fabricators of Machine Bases and Frames and Many Other Welded Steel Plate Products

The
IRON AGE

ESTABLISHED 1855

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MORE STEEL

THE Allies are welding a collar of steel around the necks of the Axis powers. In the areas particularly where Germany and Italy will soon stand beleaguered, the job is ahead of schedule.

More than 60 per cent of the steel for this collar that will choke Axis ideology to death must come from the United States. There is no other place from which it can come because of the relative producing capacities of the Allied nations.

When war effort at the front is speeded up, as it has been so gloriously during the past weeks and as we hope it will be similarly accelerated during the months immediately ahead, steel consumption is speeded up in even greater measure. And steel supply must receive a similar impetus. The big push for victory starts in our mines and steel mills and its efficacy depends upon their performance.

So the Commander-in-Chief has called for many more tons of steel than were anticipated, for the third and fourth quarters of this year, from the steel mills of America. A tremendous job, this, which challenges every man and woman in our industry, but it will be done.

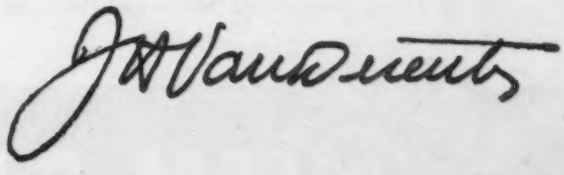
It must be done. But it can only be done if government, management and labor completely lay aside all thought of group advantage and unite wholeheartedly in a determined purpose to achieve this objective.

I believe that there is enough patriotism and statesmanship in management and labor in our industry to do just that. After all, we Americans at home are the same breed as the Americans who are fighting at the front and they raise no question of class distinction when asked to die for their country. The least we can do is to work for it with equal unselfishness.

The steel industry has been doing a wonderful job. Except for the past few weeks when, thanks to John Lewis, coal became restricted by strikes, the production rate of steel has averaged over 98 per cent of practical capacity. Anyone familiar with the steel industry knows what it means and what it takes to hang up such a record.

If Mr. Lewis is finally put where he belongs, the steel industry will do its part in doing the impossible. American progress has been built on broken records. But the consumers of steel must do their share too. A ton of steel put into the channels of supply from excessive inventories is worth two tons in our steel furnaces as measured in military effect.

With every man in the industry convinced of the fact that in his daily work of making available more and more steel he is carrying a rifle, or dropping a bomb or manning a plane just as truly as though he were fighting at the front in Uncle Sam's uniform, there will be no trouble in getting those extra tons.



Don't Throw It Away!

It Isn't a Total Loss

Great war-time value still remains in cutting tools even though they are broken, or worn beyond further use. They contain precious alloys, some of which cannot be replaced at any price—alloys that are essential for the manufacture of replacement cutting tools—alloys that are vital for the production of war equipment, upon which depend the lives of our fighting men, and ultimate victory.

Machine operators can make a real contribution to the war effort if they will care for their tools—keep them properly sharpened—protect them from damage or loss—use them under conditions that will give the longest possible life. Many tools are lost or broken through carelessness. Some can be repaired.

But if tools can no longer be used, *don't throw them away!* Gather and segregate them so they can be sent to steelmakers, who will charge them into furnaces, saving all the critical alloys for new tools and war equipment.

An important part of the fight on the home front is to save critical alloys. Work out a plan today to collect and segregate all alloy-steel scrap in your plant.

ARMY E NAVY

INLAND STEEL CO.

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The IRON AGE
JUNE 24, 1943

NEWS FRONT

Frictions are becoming too great for WLB to cling much longer to its fairy story living-cost formula. California CIO Council's research department recommends $2600 a year as necessary to maintain workers under present conditions. West Coast AFL teamsters say $2425, and building service employees say $1800.

More steel will be required by the accelerated locomotive construction program alone than has been saved by the over-publicized cut-back in tank construction.

No metal will be available for civilian products in 1943 and 1944, other than for those repair parts absolutely necessary to keep the civilian economy operating at a subsistance level.

The famous Hurricane has bred the Hawker Typhoon, which the British consider the best fighter plane of 1943. Weighing about one-half our Thunderbolt, it has somewhat more power, a 2400 hp. Napier Sabre, 24-cylinder, liquid cooled, H-type, in-line motor. Whereas Americans lean toward 0.50 cal. machine guns, the British like cannon. Typhoon carries four streamlined 40 mm. cannon in the wings.

Another minor gesture in recognition of organized labor's long ignored insistence for a greater administrative part in the war effort was WPB's appointment last week of C. S. Golden (CIO) and J. D. Kennan (AFL) as vice-chairman for manpower liaison and labor prcduction respectively.

During the last 60 days sufficient extrusion presses have been installed to more than double previous capacity. Through labor cooperation, time of installation was halved. The increasing amount of extrusions being designed into planes had brought deficiencies in facilities to a head last winter.

OPA, currently the victim of minor blunders and major attacks of special interests, apparently must look in vain for a pat on the back from the millions it has helped.

German internal propaganda is now concentrating on making the civil population buy the "people's gas mask". Some districts have had a free issue. Technical journals there are devoting considerable attention to new methods of spraying poison gas from aircraft.

End uses of stainless steel in the aircraft industry are currently being reexamined and soon instructions will be issued to assure use of leaner alloys wherever possible.

Budd Mfg. Co. is currently testing the first all-stainless steel cargo plane made in this country, or for that matter in any country. The construction program calls for considerably more than the 500 originally announced.

Incidental intelligence: Wendell Willkie and Jim Farley were disporting at the Biltmore roof garden last Friday. They were sitting 18 ft. 3½ in. apart.

Berlin has announced the arrival of a new Japanese bomber, and a new bomb which explodes 500 ft. before reaching the ground.

NE steels made up 25 per cent of all alloy steel production in May, as against 5 per cent for July, 1942.

Abrasion and corrosion tests on tableware, by the Quartermaster Corps, showed that 0.0002 in. of chromium plated onto case hardened steel stood up best.

Apparently no effort is being made to open up ore bodies in Texas for the new Houston and Daingerfield blast furnaces, despite all the original ballyhoo of utilizing those resources. Probably ore will come from South America for the two stacks.

Great minds in the same channels: Ordnance is turning down a lot of inventors with good ideas simply because the projects are already in an experimental or production stage. They don't dare tell the inventor, who usually leaves frustrated and outraged.

Cold reduced tin plate now accounts for 99 per cent of total tinplate output. Pioneered in 1929 by Wheeling Steel Corp., production then was 0.2 per cent of the total; in 1935, 24 per cent.

Last week Wilkeson Products Co., Tacoma, Wash., made its first coke; Pacific Carbide Co. will start in about 30 days; and, Coast Carbons Co., which will make charcoal from wood waste, expects to get going in the near future.

The Annealing of Steel

By PETER PAYSON

Chief Research Metallurgist, Eastern Research Laboratory, Crucible Steel Co. of America

. . . Rule of thumb annealing is relegated to a time-prodigal past by application of the modern viewpoint on the transformation of austenite. From this vantage point, the author, in a five part article beginning this week, thoroughly discusses the practical annealing of a wide variety of steels. Later in the series he presents numerous time-temperature-transformation charts with explicit data on their construction and use.

FOR very many years it has been accepted generally that slow cooling is a necessary practice in the full annealing of steel. The latest definition of full annealing, as given in the 1942 preprint of the American Society for Testing Materials, Report of Committee E-8, is:

"A softening process in which an iron-base alloy is heated to a temperature above the transformation range and after being held for a proper time at this temperature is cooled slowly to a temperature below the transformation range. The objects are ordinarily allowed to cool slowly in the furnace, although they may be removed from the furnace and cooled in some medium which reduces rate of cooling."

Also, in this committee report, the following definition is given: "Spheroidizing—Any process of heating and cooling steel that produces a rounded or globular form of carbide. Spheroidizing methods frequently used are as follows: (1) Prolonged heating at a temperature just below the lower limit of the transformation temperature range with subsequent slow cooling. (2) The object is subjected to a temperature which rises and falls alternately between a point within and a point just below the transformation range. This method gives good results with small high-carbon steel objects. (3) Tool steel may be spheroidized by heating to a temperature above the transformation range and then, after holding a suitable time, cooling very slowly in the furnace. (4) Tool steel containing a carbide network may be spheroidized by quenching in oil from the minimum temperature at which all the carbon is dissolved, followed by reheating to a temperature slightly below the transformation range."

In Metals Handbook, 1939 edition, the recommended practices for the annealing of various grades of steel all include slow cooling, and the following statements are made[1]. "In general, the slower the cooling, particularly through the critical range, the softer the steel. As the alloy content of the steel increases, the slower the steel must be cooled. The maximum cooling rate of 50 deg. F. per hr. down to 1000 deg. F. is suggested." In the section[2] on Oil Hardening Alloy Gears, it is stated, "To eliminate forging structure and to obtain desirable machining properties, gear blanks should be normalized and annealed. It is common practice to combine these treatments by a so-called cycle treatment consisting of heating to the normalizing temperature, rapid furnace cooling to the critical range at approximately 200 deg. to 250 deg. F. per hr. and holding in the critical range until a proper structure is developed, usually requiring several hours, then furnace cooling to 1100 deg. F. for 4145, 5150 and 6150 steels; to 1000 deg. for 3150 and 3250 steels; to 900 deg. for 4640 steel; and to 750 deg. for 3440 steel." For spline shafts made of 1355, 2345, 3250, 3450 and 6150 steels, the following treatment to produce good machining qualities is suggested[3]: "Heat to 1650 deg. to 1700 deg. F.; hold long enough to insure thorough and uniform heating, cool rapidly by opening furnace doors to 1280 deg. F.; cool slowly from 1280 deg. to 1000 deg. over a period of 6 to 10 hr."

Thus, the emphasis in these recent authoritative definitions and recommended practices is on slow cooling, at least in some part of the annealing operation. Furthermore, it is indicated that slow cooling should be continued to temperatures as low as 1100 deg. to 1000 deg. F., and hardly any distinctions are made in this respect for the wide variety of steels which are annealed commercially.

During the last five years, the metallurgists of the Crucible Steel Co. of America have studied annealing from the modern viewpoint of the transformation of austenite. Since austenite may transform at a constant subcritical temperature, as well as during a continuous cooling, it is feasible to anneal steel by a constant temperature transformation instead of by the traditional slow cooling procedure. With this idea as a basis, certain metallurgical principles of annealing have been established. These have led to the development of annealing operations in which slow cooling may or may not be used, depending on the transformation characteristics of the steel, the mass of the steel being handled, and the furnaces in which the steel is being annealed.

Statement of Principles

Although the term "annealing" covers the heating of steel to temperatures below the critical, as well as to temperatures above the critical, this discussion will give only slight attention to sub-critical annealing operations. The latter are quite simple and straightforward. They serve to remove stresses in steel caused by straightening or other mechanical operations; to soften cold worked steel

CASTINGS from a heat treating furnace. This type of load has poor heat transfer characteristics. Relatively slow cooling cannot be avoided in such loads, but such retarded cooling should be carried out only as slowly as is necessary for control of uniformity of temperature distribution.

and to recrystallize cold worked ferrite; to agglomerate carbides and in some degree to spheroidize lamellar pearlite. The rate of cooling subsequent to a sub-critical heating has practically no effect on the hardness or structure of the steel, since no metallurgical change occurs during the cooling. The only possible change during cooling is a precipitation of carbides which may have dissolved in the ferrite, but since the amount of carbide dissolved in ferrite at temperatures just under the critical is extremely small, the effect of the cooling rate on the precipitation, or the prevention of precipitation, of this small amount of carbide can be of no practical importance in most steels.

It will be understood, therefore, in the discussion to follow, that only annealing by heating to temperatures above the critical is under consideration. It should further be understood that any reference to temperature means temperature of the steel, and not temperature of the furnace in which the steel is heated, unless specific mention is made of furnace temperature. Finally, it should be understood that any reference to "critical temperature" means only the temperature at which austenite begins to form when steel is heated, or the temperature usually referred to as Acl, or Ael. The latter is emphasized because the established definitions of annealing and descriptions of annealing methods, referred to earlier contain the expressions "transformation range" and "critical range" and it is the author's opinion that such expressions are not sufficiently definite.

Annealing depends almost entirely on two factors, namely, the formation of austenite and the subsequent transformation of the austenite at high temperatures. The more carefully these factors are controlled, the more successful is the operation.

The formation of austenite is relatively simple. In the natural or as forged or as rolled condition steel consists almost invariably of ferrite and carbide in a wide variety of mixtures depending on the composition of the steel, the finishing temperatures, and the cooling conditions of the bars or forgings. These mixtures may be free ferrite and pearlite, or pearlite with a carbide network; or pearlite with no proeutectoid constituent; or fine, close packed spheroids in ferrite; or an intermediate transformation product like bainite. In some of the higher alloy steels, martensite, and even retained austenite, may be found in the "natural" steel. All of these structures can be converted to austenite by heating the steel to a temperature above the critical. The temperature above the critical to which the steel is heated is called the austenitizing temperature. Although austenite is formed as soon as the temperature of the steel exceeds the critical, the structure of the steel is by no means entirely austenite as soon as the critical temperature is passed. At low austenitizing temperatures the structure consists of austenite plus carbides or ferrite, or even both, depending on the composition of the steel, and the time at the austenitizing temperature. In hypoeutectoid steels the carbides dissolve fairly rapidly in the austenite at relatively low austenitizing temperatures. In hypereutectoid steels the carbides do not dissolve at low austenitizing temperatures, but they may agglomerate. As the austenitizing temperature is increased, there is more and more conversion of ferrite to austenite in the hypoeutectoid steels, and more and more solution of the carbides in hypereutectoid steels. In other words, the structure of the steel becomes more and more homogeneous as the austenitizing temperature increases, although in some hypoeutectoid steels such as high chromium Type 410 stainless steel, and in many hypereutectoid steels such as high speed steel, the structure never becomes completely homogeneous, but always consists of either austenite

and ferrite, or austenite and carbide. This homogeneity, or lack of homogeneity, is an important consideration in the development of annealed structures, as pointed out by Mehl[4], and it is the basis of the first rule of annealing, which is:

Rule 1: The more homogeneous the structure of the steel as austenitized, the more completely lamellar will be the structure of the annealed steel. Conversely, the more heterogeneous the structure of the steel as austenitized, the more completely spheroidal will be the structure of the annealed steel. This may also be stated as follows: The higher the austenitizing temperature, the greater is the tendency for the structure of the annealed steel to be lamellar, whereas the closer the austenitizing temperature is to the critical temperature, the greater is the tendency for the structure of the annealed steel to be spheroidal.

The austenite which was formed from ferrite and carbide when the steel was heated above its critical temperature, transforms back to ferrite and carbide when the steel is again cooled below the critical. This transformation is a relatively slow process at some temperatures, and may be very rapid at other temperatures. Furthermore, at some given sub-critical temperatures, one composition of austenite may transform rapidly whereas another may transform very slowly. Finally, the transformation product, that is, the mixture of ferrite and carbide which results from the transformation of the austenite and which constitutes the final structure of the annealed steel, depends to a large degree on the temperature at which the austenite is permitted to transform.

If the austenite is permitted to transform at temperatures just below the critical, say less than 25 deg. F. below, the product may be relatively coarse spheroidal carbides, or coarse, lamellar pearlite, that is, pearlite of relatively wide interlamellar spacing and thick carbide plates, depending on the composition of the steel and the temperature to which the austenite had been heated. In other words, at temperatures just below the critical, a heterogeneous austenite will transform to a spheroidal structure, and a homogeneous austenite will transform to a lamellar structure. The product formed at temperatures just under the critical is very soft. However, the time required for austenite to transform completely at temperatures just under the critical is usually quite long and may be a matter of days or weeks.

The principles set forth in this discussion are covered by Patents 2,188,155 and 2,251,289 issued to the author and assigned to the Crucible Steel Co. of America. In the belief that they may be of use in the war production program, the principles are made available by the company to anyone wishing to utilize them.

In the development of these principles, the author gratefully acknowledges the assistance of the staff of Crucible Steel Co.'s Eastern Research Laboratory and of the metallurgical departments of all the company's plants, which have helped apply these principles to actual commercial practice.

When the austenite is permitted to transform at lower temperatures, say 50 deg. to 100 deg. F. below the critical, the transformation product is not quite as coarse as that formed just under the critical, and it is harder, but the time required for the completion of the transformation is shorter and, in many cases, very much shorter. Also, at the lower temperature, the transformation product in many low alloy steels has a greater tendency to be lamellar rather than spheroidal, even though the austenite was heterogeneous before transformation started.

At still lower temperatures the transformation product is a much denser mixture of ferrite and carbide and has a greater hardness. In many steels the time for the completion of transformation decreases with decreasing temperature to a minimum at about 100 to 200 deg. F. below the critical, and then increases again at lower temperatures. In others, notably in plain carbon steels and in the higher manganese and nickel constructional steels, the temperature of most rapid transformation is about 400 to 500 deg. F. below the critical.

These facts are the bases for the second and third rules of annealing, which are:

Rule 2: To develop the softest condition in steel, austenitize at a temperature usually less than 100 deg. F. over the critical, and transform at a temperature usually less than 100 deg. below the critical.

Rule 3: Since the time for complete transformation at temperatures less than 100 deg. F. below the critical may be very long, allow most of the transformation to take place at the higher temperature where a soft product is formed and finish the transformation at a lower temperature where the time for the completion of transformation is short.

After the steel has been austenitized at a temperature usually about 100 deg. F. above the critical, it must be cooled to a transformation temperature usually about 100 deg. below the critical. Very little change can take place in the structure of the steel during this cooling over a range of about 200 deg. In hypoeutectoid steels, some ferrite may separate from the austenite during slow cooling down of the transformation temperature, before the ferrite plus carbide transformation occurs. This ferrite usually occurs in bands, or it may come out as a network at the boundaries of the austenite grains. From a machinability point of view, the presence of a large amount of free ferrite in the structure of the annealed steel is usually undesirable and should be kept to a minimum. In hypereutectoid steels, carbides may separate from the austenite during the cooling to the transformation temperature, but this does not occur ordinarily. Since it is established that nothing of importance to the success of the annealing operation occurs during the cooling between the austenitizing and the transformation temperatures, the fourth rule of annealing is:

Rule 4: After the steel has been austenitized, cool it as rapidly as feasible to the transformation temperature in order to decrease the total time of the annealing operation.

If the steel is being annealed in a batch type furnace, it may be feasible in this cooling merely to shut off the heating units. If the steel is being annealed in a continuous furnace, it would be feasible to move the steel directly from the zone of austenitizing temperature to the zone of transformation temperature, or even into a bath at the transformation temperature. In any event, there is no metallurgical reason for slow cooling during the change from the austenitizing to the transformation temperature.

After the steel has been held at the transformation temperature for a time which is sufficient to allow the transformation to go to completion, there is nothing further which can occur in the steel during the cooling from the transformation temperature to room temperature. Extremely slow cooling may cause some agglomeration of carbides and consequently some slight further softening of the steel, but the effect is negligible in comparison with the results obtained by high temperature transformation. The fact is that, after the austenite is transformed completely, even though the transformation may be at temperatures as high as 1400 to 1450 deg. F. as it is in many high alloy steels such as high speed steel, the

steel may be quenched in water without affecting the structure or the hardness of the annealed steel. The fifth rule of annealing is:

Rule 5: After the steel has been completely transformed, at a temperature which produces the desired microstructure and hardness, cool the steel to room temperature as rapidly as feasible, in order to decrease the total time of the annealing operation.

In many annealing departments it may be feasible, during this cooling from the transformation temperature down to room temperature, merely to shut off the heating units and open the doors of the furnace, or to remove the hood, and to allow the steel to remain on the furnace floor until the temperature of the steel is low enough for men to handle it. In a continuous furnace it would be feasible to move the steel directly from the zone of transformation temperature to a cold zone or even into a water bath. However, whatever the conditions may be, there is no metallurgical reason for cooling the steel slowly after the transformation has been completed.

Finally, there are two supplementary rules of annealing, which are:

Rule 6: To assure a minimum of lamellar pearlite in the structure of annealed 0.70 to 0.90 carbon tool steel and other low alloy, medium carbon steels, preheat the steel for several hours at a temperature about 50 deg. F. below the critical, before the steel is austenitized, then austenitize and transform as usual.

Rule 7: To obtain minimum hardness in annealed hypereutectoid alloy tool steels, heat the steel for a long time, about 10 to 15 hr., at the austenitizing temperature, and transform as usual.

Both of these procedures tend to establish in the austenite residual carbides which serve as nuclei for the formation of coarse spheroidal carbides during the subsequent transformation of the austenite. These procedures will be discussed fully in Part V of this article, to appear July 22.

These rules emphasize that the two important steps in the annealing of steel are the heating to form austenite, and the subsequent holding in the sub-critical region to transform the austenite. Obviously, the steel must be cooled from the higher temperature to the lower temperature, and finally to room temperature. In many cases this cooling can be done rapidly, with a considerable saving in the total time required for the annealing operation. In many other cases, however, the cooling cannot be done rapidly because of the mass of steel being annealed in one load, or because of the large size of the pieces being handled. In these cases, such as loads of 20 tons or more of bars; or of smaller loads of bars packed in pipes or boxes; or loads of heavy coils of strip; or loads of ingots or forgings, 10 to 18 in. in section, relatively slow cooling cannot be avoided merely because heat cannot be dissipated rapidly from the inside portions of these masses. It is for this reason that in the rules given above the statement is made, "cool as rapidly as feasible." When large masses are being annealed, it may not be feasible to cool rapidly because under forced cooling the outside of the load will cool more rapidly than the inside, and the operator will not be able to control the metallurgical reactions desired. However, the rate at which such retarded cooling is carried out should be only as slow as is necessary to give the operator control of the uniformity of temperature distribution throughout the load and, at the same time, to allow sufficient time for the steel to transform to the structure required. The relationship between cooling rates and transformations in steel will be discussed in Part III of this article, July 8, in which it will also be shown that the temperature at which controlled cooling may be stopped depends on the transformation characteristics of the steel. Here again practical considerations may require retarded cooling below the temperature at which metallurgical reactions cease. One of these is the time required for the dissipation of heat from the center to the outside of a large mass of steel. Another may be the physical difficulty of handling large masses of hot steel.

One factor which may contribute to the failure of an annealing operation is lack of knowledge of temperature distribution within the load of steel. The furnace thermocouples indicate the temperature of the space above, or below, or at the side of a load of steel in the furnace, but this temperature may be 50 deg. F., or more, different from the temperature of the steel, especially when the steel is in a pipe or box, or when bars or strip are packed in a dense charge in a quiescent atmosphere. When these conditions exist, it is desirable to establish the temperature distribution throughout the load during heating and cooling by placing thermocouples among the bars or forgings in the furnace. The regulation of the furnace during the annealing operation should be based on the temperatures indicated by the thermocouples in contact with the steel, rather than on the temperatures indicated by the side or top furnace thermocouples.

But the factor of most importance in the development of efficient annealing operations is the knowledge of the transformation characteristics of the steel being annealed. Some steels transform to soft products quite slowly, and it is not surprising that attempts to anneal such steels by continuous cooling at rates of 50 deg. F. an hr., or faster, were not successful. Long before the transformation of austenite was understood, it had been established empirically that steels could be made soft if they were cooled at slower and slower rates. This was undoubtedly a corollary to the prevailing opinion in the early days of steel metallurgy that the faster a steel was cooled, the harder it would be.[5] When a steel did not have a satisfactory low hardness after an annealing operation, it was the practice to re-anneal it with a slower cooling rate than had been previously used. Eventually, cooling rates were established as slow as 20 deg. F. an hr., and even 10 deg. an hr. As long as it was necessary to cool the steel very slowly, it was more economical to run large loads than small ones, since a large amount of steel could be cooled at a slow rate just as easily as a small amount. Larger and larger furnaces were therefore built for annealing steel, and furnaces large enough to anneal 20 tons or more of steel bars at a time are not uncommon. The larger the furnace, the more difficult it is to establish and maintain uniform temperature conditions throughout the load of steel and the more difficult it is to change steel temperatures during both heating and cooling.

It is known now that many steels may be annealed in relatively short times, and for such steels a continuous furnace operation is altogether feasible if the parts being handled are sufficiently small for temperature changes to take place in them fairly rapidly. The transformation behavior of a steel determines whether or not it can be annealed in a short time.

Much data on the transformation characteristics of a variety of steels have already been published,[6 to 17] and additional data are to be presented in this paper. Furthermore, such data are fairly easy to establish in many metallurgical laboratories by the procedure described in the next section.

References

[1] Metals Handbook, A.S.M. 1939 edition, p. 987.

[2] Ibid, pp. 969, 970.

[3] Ibid, p. 978.

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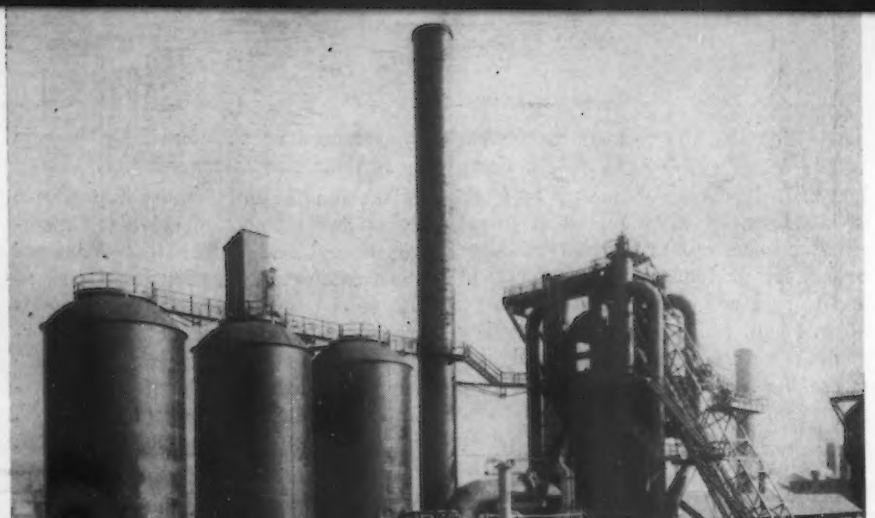

Arc

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BLAST furnace No. 3 of the Weirton Steel Co. was entirely fabricated of arc welded construction at a saving of 35.2 per cent over the riveted design.

INCREASED production of steel, so vital at present, is partly created by the reduced time required to build a welded blast furnace, permitting its operation to begin months earlier. The conventional riveted blast furnace requires 12 months to build. The first welded furnace the Pittsburgh-Des Moines Steel Co. built began pouring iron eight months after work was started.

One of the first furnaces to be built under the present war expansion program was Furnace No. 3 for the Weirton Steel Co., Weirton, W. Va., which was fired in December, 1941. It has a rated capacity of 400,000 tons a year—slightly more than 1000 tons a day. In the fabrication of this furnace, the advantages of arc welding were applied to all of the structures involving essentially steel plate work —the blast furnace shell, mantel, tuyere breast jacket, bosh bands, hearth jacket, dust catcher, whirler, hot blast stoves, gas and air piping and walkways.

When the recent rapid expansion of the steel industry became necessary, it was thought by some, that to save time in building new furnaces, duplicates of the older furnaces should be made. This would eliminate to a certain extent the preparation of new designs and detail drawings. But upon further consideration, the advantages of arc welding offset this savings so that practically all of the furnaces built recently have been welded.

The Weirton Steel Co., acting as general contractor on this project, had requested separate bids at different times on the various steel structures. The first of these was for the blast furnace shell and mantel, based on a riveted design. We suggested as an alternate an arc welded design. The estimated cost of the two structures indicated a substantial saving by using the welded design, Fig. 1. In view of this fact, the remaining structures were then considered only on the basis of a welded design.

Furnace Shell

The blast furnace and its accessory equipment, including the gas cleaning apparatus, the piping and the hot blast stoves, were designed for an internal pressure of 30 lb. per sq. in., besides the weight of the structures, the loads of ore, coke, limestone, dust, brick lining and wind pressure. The furnace shell, made of ⅞, 1 and 1⅛ in. thick plates, was entirely butt welded, Fig. 2. It has 11 courses, six plates to the course. All of the vertical joints were of the double U type, with the edges prepared by planing. The horizontal joints were double V. These edges were gas cut. The bottom of the shell was welded to the mantel with a double J joint.

The mantel, having 1⅛ in. thick flanges and a 2½ in. thick web, was also butt welded. It was shop fabricated in eight sections. The flanges were designed and shop welded to the web in such a way so as to reduce to a minimum the tendency to warp or distort the sections. In the field, these sections were welded together to form a complete ring. The webs all were joined by using a deep single U joint. This permitted all down welding. At the top of the shell, the top ring steel casting, made in four parts, was attached to the plate with welds as small as was practical—⅜ in. fillets on each side.

The butt welded joints of the shell and mantel required special consideration in detailing the plates. A shrinkage of ⅛ in. was estimated at each joint in the shell plates. Therefore, the plates were detailed and fab-

Welded Blast Furnace

. . . A saving in overall costs of $153,830 in plate fabrication and erection of the No. 3 blast furnace of the Weirton Steel Co. is shown by the author. The original paper, from which this article is abstracted, won a prize of $2700 in the recent $200,000 Industrial Progress Award program of the James F. Lincoln Arc Welding Foundation.

ricated to the size required on the basis that the edges of the plates touched, then they were erected with a ⅛-in. gap between the edges.

A special welding procedure was also necessary. The method was to outline a means of welding the joints in a sequence so as to reduce as much as possible a tendency to distort the structure due to the shrinkage of the joints. The following is the procedure as outlined by our welding engineer:

1. Filler rod metal

Fleetweld No. 5 for all seams.

2. Qualification of welders

All welders must have passed previously the A.W.S. Qualification Test for the types of joints shown on the drawing or they must take the A.W.S. Qualification Test on the job before starting to weld. A record of each welder shall be kept by the foreman and papers for each new welder should be sent to the office.

3. General

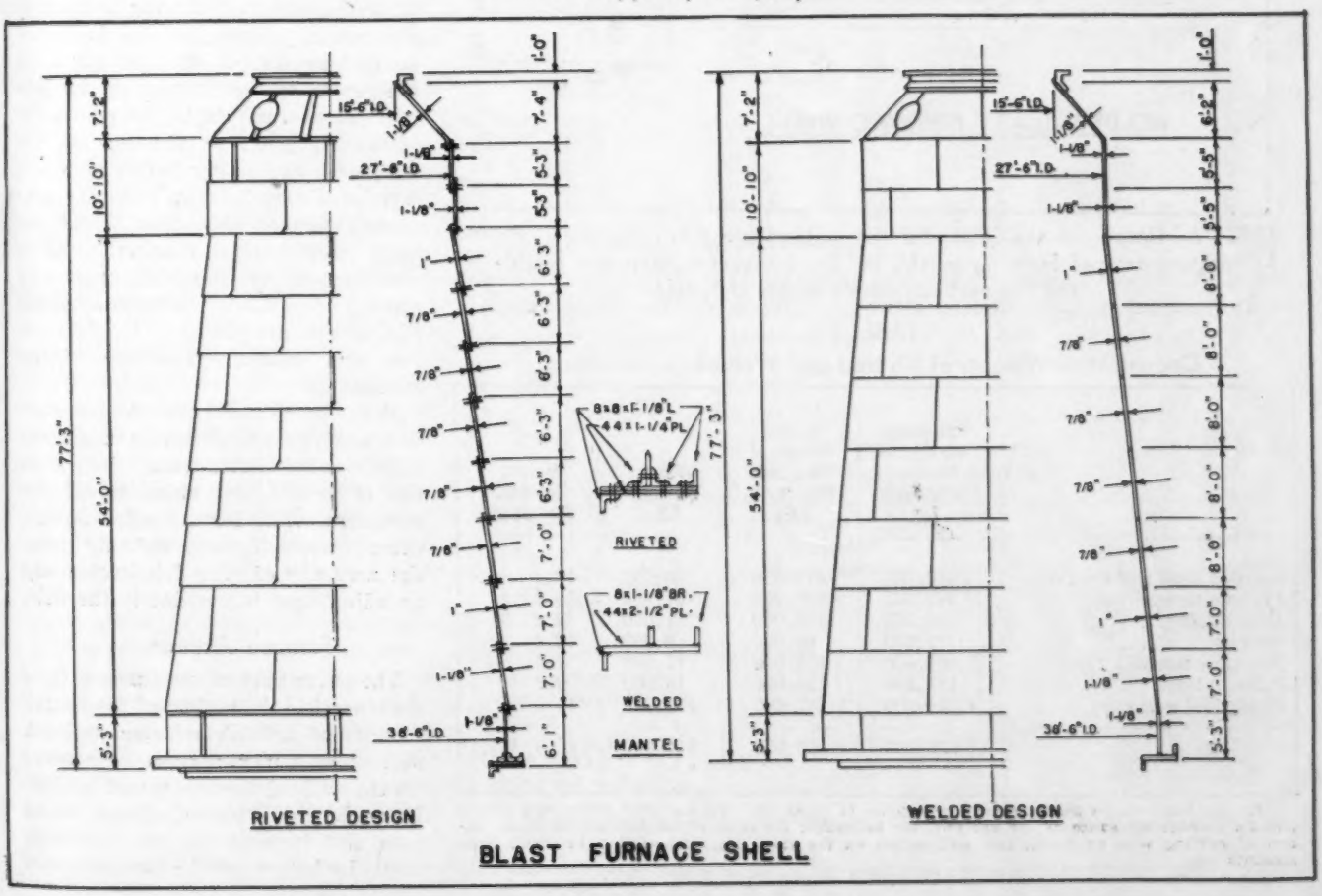
Each bead of welding shall be peened only sufficiently to break up slag. Chip out all cracked and poorly fused tack welds.

o o o

FIG. 1—General features of design of the welded blast furnace shell (right) as compared with the riveted design with overlapped joints (left).

4. Procedure

(A). Erect mantel sections FM1 and FM2 and tack them together with the edges of the mantel sections in contact. Do not attempt to bolt the mantel ring to the columns with the 2 in. round bolts before the mantel is entirely welded. The mantel ring has been fabricated oversize to accommodate the welding shrinkages in the joints, and it is, therefore, impossible to line up the holes in the mantel with the holes in the top of the columns until the mantel has been completely welded. The mantel may, however, be



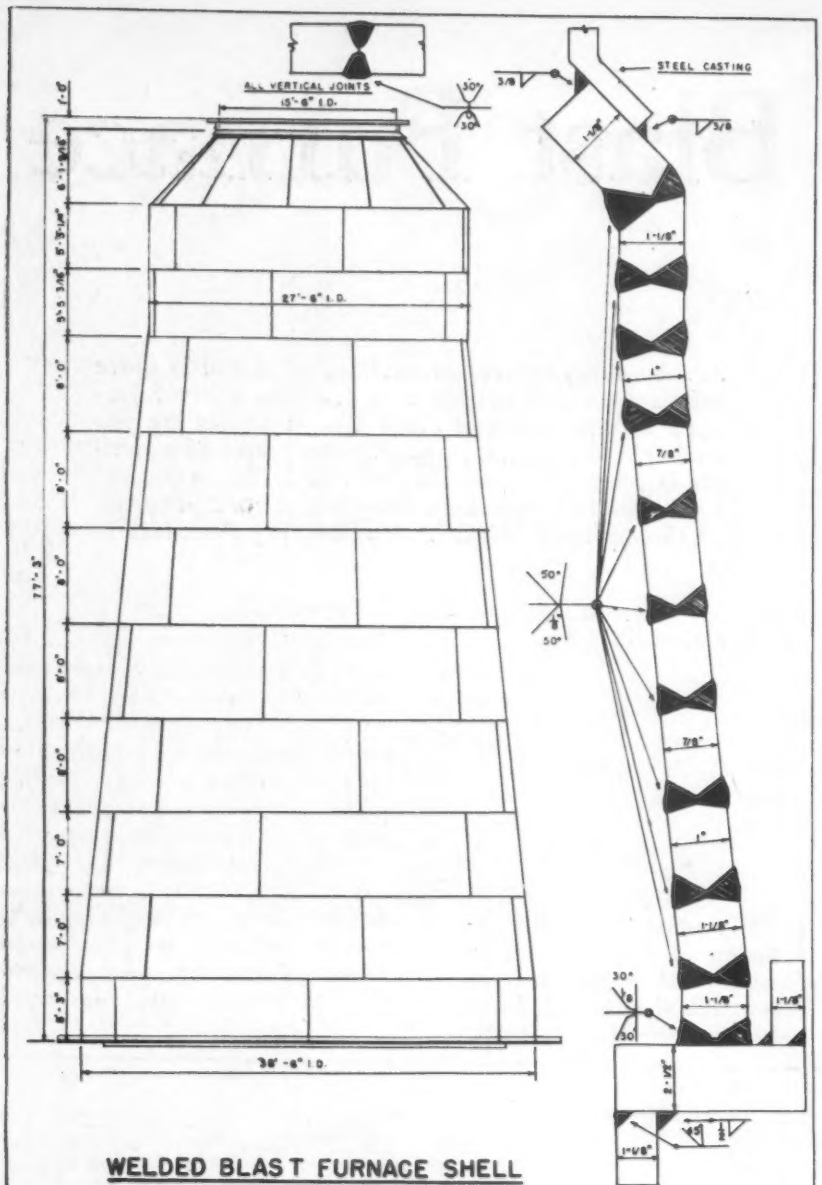


FIG. 2—Details of the joints for the welded blast furnace shell. Plate thickness ranged from 7/8 to 1 1/8 in. The horizontal joints are double V and the vertical joints, double U type.

TABLE I

Comparative Weights of Riveted and Welded Construction

	Estimated Weight of Riveted Structure Lb.	Actual Weight of Welded Structure Lb.	Weight Savings Lb.	Weight Savings Per Cent
Furnace shell and mantel	510,000	412,000	98,000	19.2
Furnace accessories	163,000	132,000	31,000	19.0
Dust catcher	205,000	184,000	21,000	10.2
Whirler	77,000	69,000	8,000	10.4
Hot blast stoves	903,000	832,000	71,000	7.9
Exhaust stack	153,000	138,000	15,000	9.8
Piping and walkways	1,215,000	1,042,000	173,000	14.2
Total	3,226,000	2,809,000	417,000	12.9 (Avg.)

On the basis of the published mill base price of $2.10 per cwt. for steel plates and shapes plus an average allowance of 15c per cwt. for unloading the steel at the fabricating plant, the cost of welding wire or rivets, and mill extras on the steel, etc., the savings in metal costs amounts to:

($2.10 + .15) x 4170 cwt. = $9370

bolted lightly to the columns so as to hold it in approximate position with bolts that are 1½ in. or less in diameter. These bolts must be removed after the joints of the mantel have been continuously welded and be replaced with the 2 in. round bolts.

(B). Establish the inside of the shell with punch marks spaced at about 12 or 18 in. intervals on the top surface of the mantel.

(C). Erect the first ring of the shell by first tacking the vertical joints and then tacking the first ring to the mantel so as to hold the inside of the ring to the punch marks.

(D). After the first ring is rounded out and tack welded, the remainder of the shell and furnace top may be erected.

(E). Weld at least one-half of each vertical joint above and below a horizontal before that horizontal joint itself is welded.

(F). The furnace top should be welded in the following sequence: The radial joints first, the top plates to the shell second, and finally the plates to the top ring casting.

(G). Erect and bolt the liner castings on the furnace top after it has been entirely welded.

A furnace shell requires exceptional care in fabrication and erection if the complete structure is to be accurate in alinement and elevation. After this shell and top casting were erected and welded, a plumb-line dropped from the center of the top casting to the bottom of the furnace indicated no measurable out-of-alinement from the center of the furnace at the bottom. Measurements to determine the actual elevation at the top of the flange of the casting indicated a difference of only 1/16 in. from the previously figured elevation. These results indicated a thorough understanding of welding shrinkage and distortion problems and the application of this knowledge to the fabrication and welding procedure of the structures.

It should be noted that during erection and welding there is a certain amount of control, within limits, of the alinement and elevation of the structure, while for a riveted design, these factors depend entirely upon the accuracy of shop fabrication and no adjustment is possible in the field.

Furnace Accessories

The lower part of the furnace from the mantel to the bottom of the hearth consists of a thick circular firebrick wall. The upper portion is encased by the welded tuyere breast jacket. Through this water-jacketed band pass the tuyeres. In the firebrick from the bottom of the tuyere breast

jacket to the bottom of the hearth are embedded steel reinforcing bands. There are eight bosh bands made of 12 x 1½ in. bars. Each band is made in four sections. Splice bars are welded to the ends of the bars in the shop. The rings are bolted together in the field. They range in diameter from 32½ to 38½ ft. and are placed one on top of the other, increasing in diameter toward the top. The bands are separated about 6 in. by spacer castings. Below these are four hearth jacket bands made of 12 x 1¾ in. bars. The splices are similar to those on the bosh bands.

Dust Catcher

The dust catcher, Fig. 3, is the first in a series of gas cleaning units. The exhaust gas from the top of the furnace is conveyed through the uptake and downcomer pipes into the side of the dust catcher. About 40,000 cu. ft. of gas per min., at a considerable velocity, passes into this large container where a reduction in velocity permits the larger particles of coke, limestone and ore dust to settle to the bottom. The gas then passes out through an opening at the top.

Some interesting design features of this welded structure are: Smooth inside surfaces of the butt welded plates, thus reducing abrasion of the plates by particles of the dust-laden gas; simplicity of the column connection to the shell; connection of the top and bottom cone sections to the shell using a butt welded joint where previous riveted designs would require expensive flanging of these plates to make a lap joint; use of a compression ring at the belt seam, consisting of an angle and a bar; and the simple welded detail transmitting the equivalent of this section around the column connection and the plain portal bracing in two panels of the tower.

Whirler Design

The exhaust blast furnace gas then passes through the whirler, Fig. 4, at an average velocity of 550 ft. per min. The inlet gas pipe enters the shell at an angle so that the in-coming gas passes around the outside of the 7½ ft. diameter uptake tube in a downward rotating motion and then passes up through this tube to the next cleaning apparatus. The gas whirling at a reasonably high velocity causes the dust particles to be thrown outward toward the shell by centrifugal force. There are 24 vertical vanes attached to the lower part of the shell to catch these particles, stopping their whirling motion and allowing them to fall by gravity to the bottom of the container. A cone,

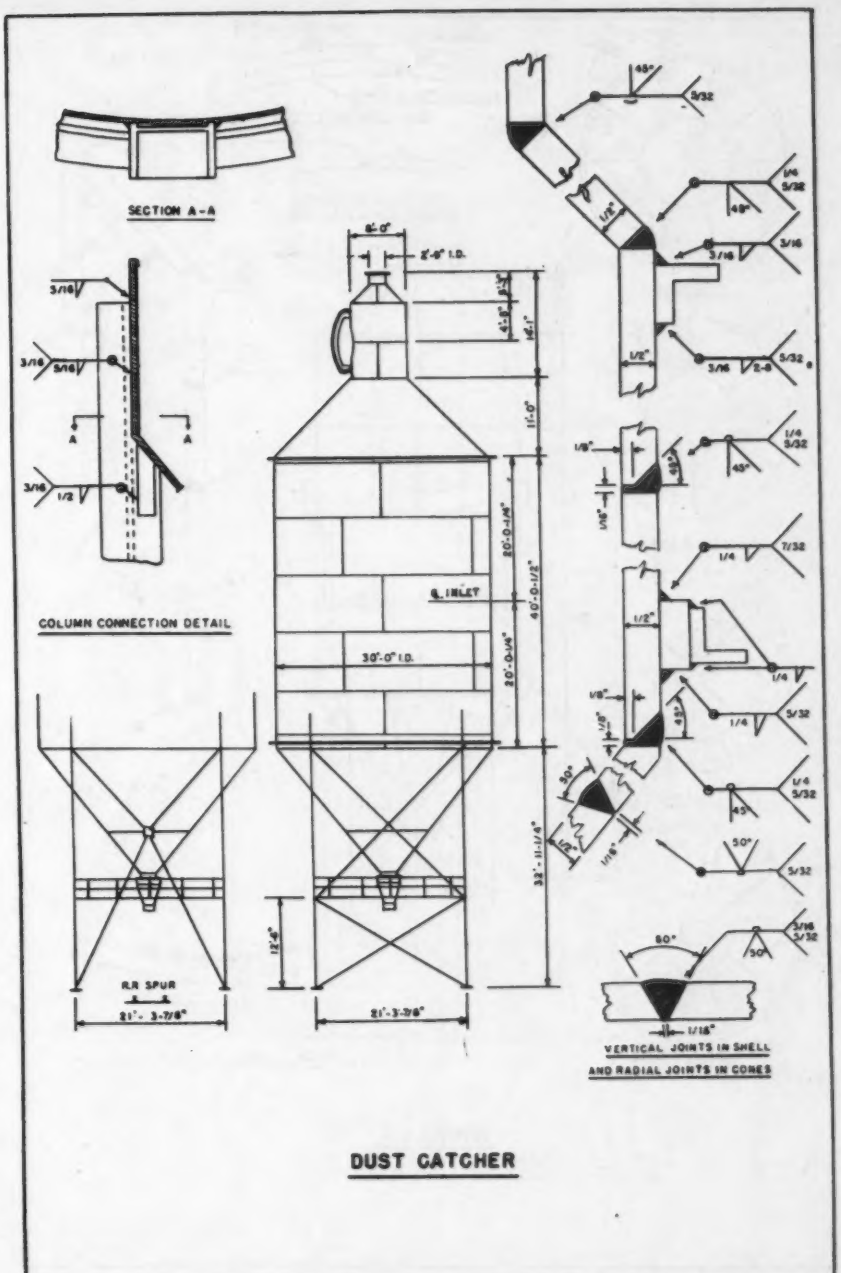


FIG. 3—Details of the fabrication of the dust catcher. The smooth inside surfaces of the butt welded plate are an advantage in reducing abrasive action of flue gas dust.

TABLE II
Drafting Costs Compared

	Riveted Design (1937)	Welded Design (1941)	Savings	Savings Per Cent
Blast furnace shell and mantel	$403	$265	$138	34.2
Furnace accessories	202	128	74	36.6
Dust catcher	654	402	252	38.5
Whirler	353	252	101	28.6
Hot blast stoves	260	196	64	24.6
Stack	215	127	88	40.9
Piping and walkways	8,270	4,730	3,540	42.8
Total	$10,357	$6,100	$4,257	41.1

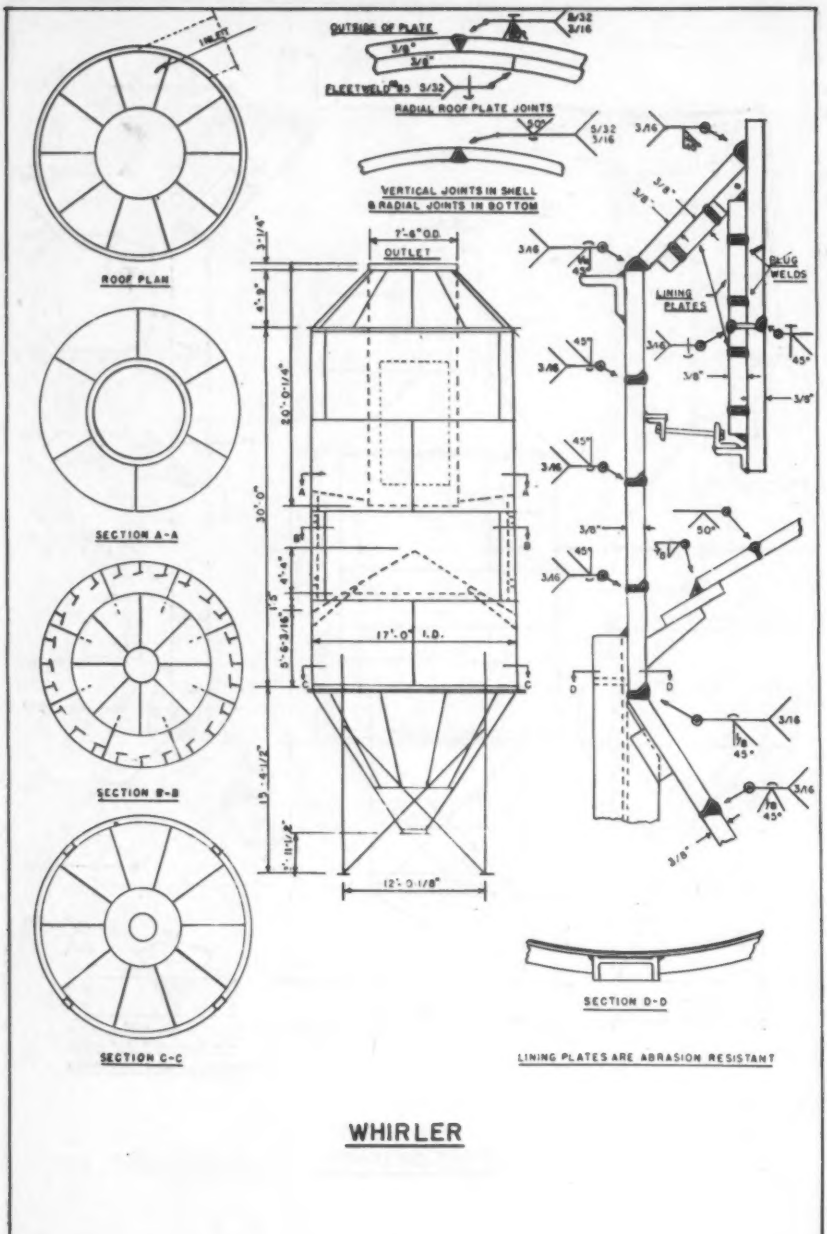


FIG. 4—Details of the whirler. High carbon steel (0.45 per cent C) plate is welded to the outside surface of the uptake tube and to the underside of the cone roof to provide an abrasion resistant surface.

TABLE III
Comparative Fabrication Costs

	Riveted Structure	Welded Structure	Savings	Savings Per Cent
Furnace shell and mantel	$9,582	$5,819	$3,763	39.3
Shop assemble and ream holes	1,880		1,880	100.0
Furnace accessories	5,275	3,067	2,208	41.9
Dust catcher	6,512	3,705	2,807	43.1
Whirler	4,367	2,543	1,824	41.8
Three hot blast stoves	11,784	7,685	4,099	34.8
Stack	2,808	1,936	872	31.1
Piping and walkways	80,346	48,840	31,506	39.2
Total	$122,554	$73,595	$48,959	39.9

smaller in diameter than the whirler itself, is placed with its apex upward in the lower part of the shell. It permits the particles of dust to fall from the vanes downward around it and also prevents the rapidly moving gas from agitating an accumulation of dust particles in the bottom.

Similar welded design features to those used on the dust catcher were incorporated in this structure. In addition, special consideration was given to the abrasion of the steel plate by the dust particles. A ⅜ in. thick abrasion resistant steel plate, having a carbon content of 0.45 per cent was welded to the outside surface of the uptake tube and to the underside of the cone roof. These plates were attached by plug welds and joints were then sealed with a filler bead of Shield Arc 85 rod. All of these welded surfaces were then ground smooth. It would have been much more expensive to provide a smooth continuous abrasion resistant surface by any other method than welding. The shell plates from the cone roof down to the vanes were protected from abrasion by a brick lining.

Hot Blast Stoves

There are three hot blast stoves of the two-pass type, each 26 ft. in diameter by 102 ft. 2 3/3 in. shell height, Fig. 5. Sixty carloads of a silica checker brick are placed in each stove. The stoves are entirely butt welded, using ⅝ and ¾ in. plates. The numerous nozzles were also welded. This construction facilitated the laying of the brickwork adjacent to the smooth inner surfaces. It also assured a gas-tight construction.

One exhaust stack serves the three stoves, it is 200 ft. high by 10 ft. 9 in. inside diameter, having a conical bell section 45 ft. 3 in. high by 20 ft. in diameter at the base. The stack is self-supporting having 24 2-in. diameter anchor bolts. The stack was fabricated of 5/16 to ½ in. thick plates, with the seams entirely butt welded.

An interesting erection feature was that the stack was so situated that a large guyed derrick placed on top of the lower 100 ft. section was used to erect the steel for all the other structures except No. 3 stove, where a basket pole was used. The steel plates and welded joints for this lower section of the stack were designed to withstand the loads during erection.

The piping for this furnace ranges from 3 to 9 ft. in diameter, fabricated from ⅜ and ½ in. plate, but welded. The hot blast main and the bustle pipe have a 4 in. brick lining. The offtakes, uptakes and downcomer have 0.7 per cent carbon wearing plates,

welded to the inside of the pipe at the various bends.

It was originally intended to shop-weld the pipe in sections of 20 to 24 ft. in length. However, due to the schedules of other jobs, the shop was not able to supply the field crew with steel fast enough to keep them working efficiently. To relieve this situation, the shop only prepared the edges and rolled the plates. They were then shipped to the location where the field crew welded the plates into sections. The costs showed no noticeable loss of efficiency. This indicates the adaptability of welded pipe designs to production scheduling.

Weight Savings

The furnace shell, whether riveted or welded, is usually made of the same thickness of plate. This ranges from ⅞ to 1¼ in., depending upon the location of the plate in the shell. The advantage of butt welding the plates arises from the consideration that the heavy butt straps or plate laps required for the riveted joints are eliminated.

The other structures, such as the dust-catcher, whirler, hot blast stoves, stack and piping and walkways also indicate a weight savings. The reduction in weight by using a welded design is also reflected in the elimination of lap or butt riveted joints and in the simplification of the structural details. The weights of the welded structures as compared with the estimated weights of these structures on a riveted basis are indicated in Table I.

The weight saving indicated not only causes a reduction in the material cost but is also reflected in a lesser handling cost during fabrication and erection and a smaller freight charge in transporting the material from the fabricating plant to the erection site.

Less Drafting Required

The preparation and checking of the detail drawings for a blast furnace are considerably simplified by using an arc welded design. Fig. 6, for instance, shows the details required by the fabricating shop to make a furnace mantel shell plate and illustrates the comparative simplicity of the drawing of the welded design. There is a similar condition for the other items on this job.

For such an installation, a considerable portion of the piping comprises bends and turns. These are made in segments having arcs from 6 to 10 deg. There is also a very large variety of T and Y intersections. The development of the plates is very involved. Lap or butt riveted joints would cause many additional prob-

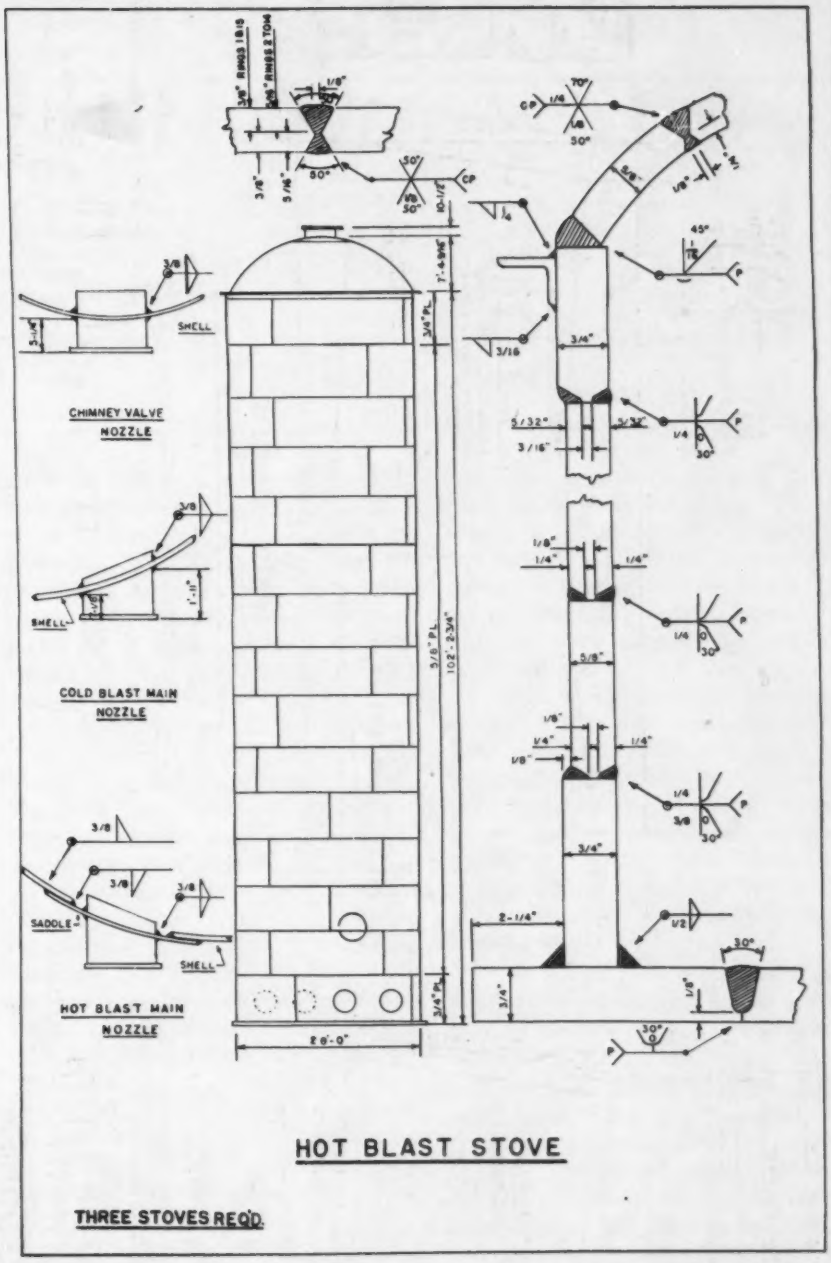


FIG. 5—The three hot blast stoves were entirely butt welded, using ⅝ and ¾ in. plates. The numerous nozzles were also welded.

TABLE IV
Comparative Erection Costs

	Riveted Structure	Welded Structure	Savings	Savings Per Cent
Furnace shell and mantel	$14,200	$7,040	$7,160	50.4
Furnace accessories *				
Dust catcher	6,970	4,150	2,820	40.4
Whirler	2,800	1,530	1,270	45.4
Three hot blast stoves	30,400	16,700	13,700	45.1
Stack	7,950	4,950	3,000	37.7
Piping and walkways	40,550	22,700	17,850	44.0
Total	$102,870	$57,070	$45,800	44.5

* The furnace accessories were erected in conjunction with the brickwork by the brick contractor.

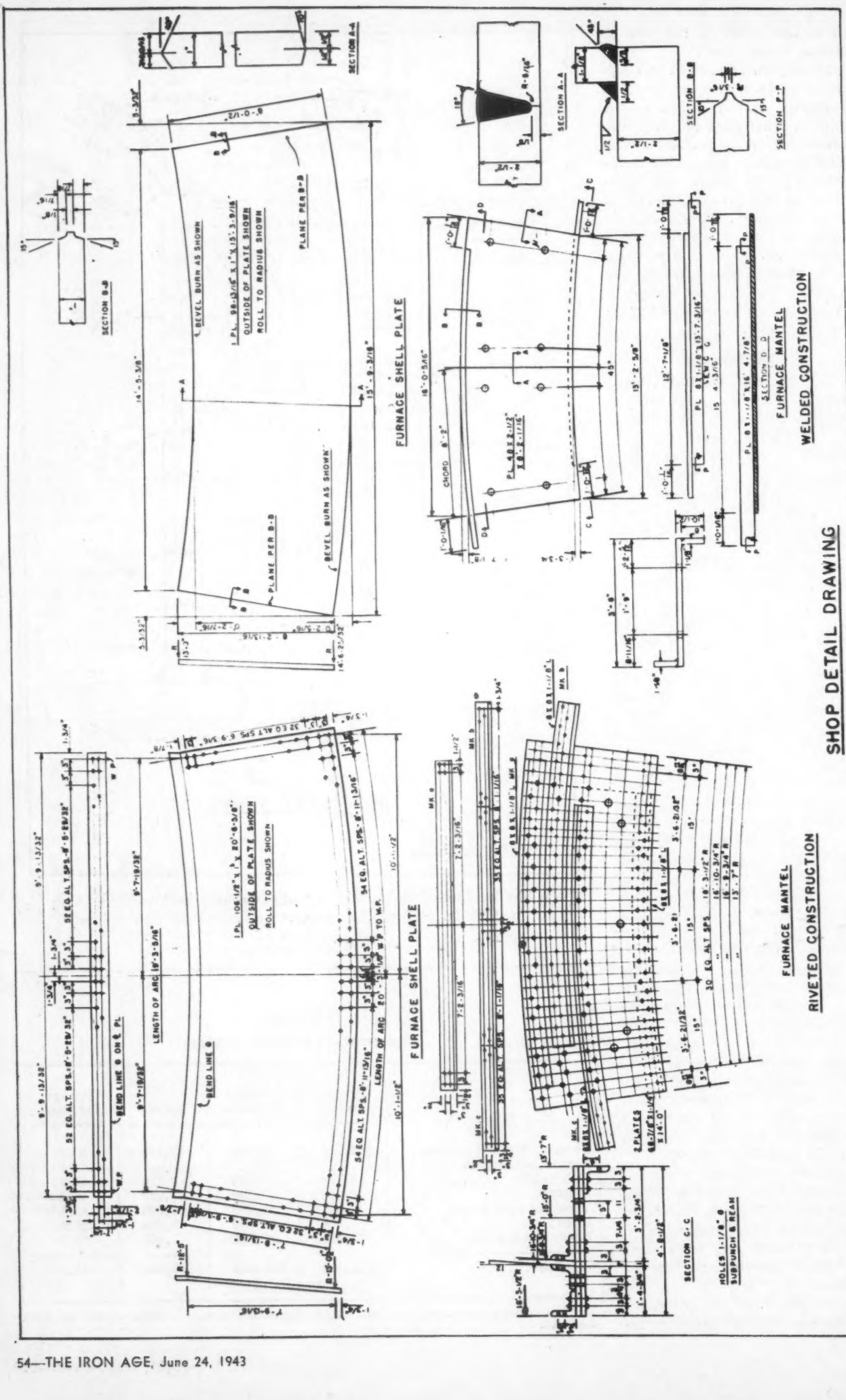


Fig. 6—Comparative shop detail drawings for a furnace mantel plate of riveted fabrication (left) and welded construction (right).

lems for the detailer. Butt welded joints simplify the drafting to the extent that the time required is reduced almost by one-half.

In addition, a riveted structure requires a rivet location layout indicating the size, length and number of rivets furnished and the joint of the structure where they are to be used. For a welded structure, the size of weld wire for each bead is indicated on a large scale section shown on the erection of assembly drawing. Table II shows the drafting costs on this job as compared to a riveted job built in 1937. The costs are given for the time required to make and check the detail shop drawings.

Shop Fabrication Costs

One of the larger items of cost of the structures is shop fabrication. Several comparisons of shop costs make the welded design more economical. Because of the lesser weight, for the welded design there is a savings in unloading the steel to the stock yard and a similar reduced cost in handling and moving the steel through the sequence of shop operations.

The first shop operation is laying out of the steel. This involves marking on the steel the dimensions that are shown on the detail drawings. Therefore, the time to prepare the drawings is an indication of the time to lay out the steel. A comparison of the costs of this operation is similar to that of the drafting costs.

As the various structures comprise primarily steel plates, their fabrication will be discussed. In the riveted design, the plates are sheared or square burned to the required size. If two plates are alike one may be used as a template for the other. Holes are punched in thin plate and holes in thick plates are sub-punched and reamed or drilled. The plate is then formed by rolling or pressing as the thickness and final shape require. After the parts of the furnace shell are fabricated, they are assembled and while in their proper position, the sub-punched holes are reamed to size. Thus for a riveted design, the furnace must be completely erected and then dismantled to assure a proper fit in the field.

Many of the plates in these structures would be bent or flanged to form a lap riveted joint. At a transition section (Fig. 1, riveted design) the plate is either hot or cold worked depending upon the thickness of the plate, radius of bend and angle of flanging.

In the welded design, after the plate is laid out, the edges are prepared by either burning or planing. The plate is then formed by rolling or pressing. Plates joined by butt welds do not require flanging at transition sections (Fig. 1, welded design). Plates fabricated for field welded construction generally do not require a shop assembly to assure an accurate fit.

A reduction in the number of pieces for an item by using a welded construction is another savings indication, due to necessary connection welds. This is particularly obvious of the blast furnace mantel.

The overhead of a weldery is somewhat lower than that of a similar shop having facilities for riveted construction. The machinery is smaller and less expensive. There are fewer tools required. Fewer operations involve lesser machinery and supervisory workmen.

Table III gives fabrication costs of the various structures. They reflect the various aforementioned advantages of a welded design.

Erection

The procedure was to first completely erect each structure, then to weld the joints, carefully following the welding sequence previously outlined. The welded design showed several advantages during erection. The erector of welded structures has the same two important tools in the field that are generally used in the fabricating shop—the burning torch and the welding machine. Of occasion he may use these to make adjustments to the shop fabricated steel. On this job, all of the openings in the structures for the pipes were burned at their proper locations, these being determined only after the structures were completely erected and welded. This procedure assured an accurate alinement. There were some instances where the piping did not fit and adjustments were made by burning and welding.

These advantages combined with a comparison of making a butt welded joint to riveting a joint are indicated in Table IV.

Other items of cost to be considered are freight, taxes, and insurance. The freight is primarily a function of the weight; the welded structures being lighter will cost less. To a less degree it is a function of the type of fabrication. Certain riveted pipe sections must be shop assembled and riveted. These large sections at times require an L. C. L. rate or a C. L. minimum charge, while if they are

(CONTINUED ON PAGE 130)

Fig. 6—Comparative shop detail drawings for a furnace mantel plate of riveted fabrication (left) and welded construction (right).

TABLE V
Comparative Total Costs

	Riveted Structures	Welded Structures	Savings	Savings Per Cent
Furnace shell and mantel	$65,750	$39,250	$26,500	40.3
Furnace accessories	10,220	6,870	3,350	32.8
Dust catcher	27,450	18,100	9,350	34.1
Whirler	14,420	9,250	5,170	35.8
Three hot blast stoves	98,210	67,880	30,330	31.0
Stack	17,410	12,150	5,260	30.2
Piping and walkways	204,100	130,230	73,870	36.2
Total	$437,560	$283,730	$153,830	35.2

TABLE VI
Summarized Costs By Functions

	Riveted Structures	Welded Structures	Savings	Total Savings Per Cent
Material	$72,550	$63,200	$9,350	6.1
Drafting	10,360	6,100	4,260	2.8
Shop fabrication	122,550	73,590	48,960	31.8
Erection	102,870	57,070	45,800	29.8
Accessories	21,340	12,180	9,160	6.0
Freight	3,540	2,930	610	0.4
Taxes, insurance, general overhead, profit	104,350	68,660	35,690	23.1
Total	$437,560	$283,730	$153,830	100.1

Stainless Steel Aircraft

THE industrial expansion of the last two years has seen fabrication of aircraft exhaust systems by many manufacturers relatively inexperienced in this field. These fabricators, together with many newcomers to the aircraft industry as a whole, have been confronted by problems seeming to cause them great concern, a discussion of which is offered here. These problems arise from the engineering applications of stainless steel to exhaust systems and have to do with the comparative advantages of titanium and columbium-stabilized 18-8 steel, carbide precipitation effects, welding of thin sheets, and metallurgical effects of zinc alloys on stainless.

These problems relate to service life and offer difficulties in discussion because of a marked scarcity of test data, accurate or otherwise, on manifold service life. While no standardized method of predicting service life has appeared, it is nevertheless possible to draw tentative conclusions concerning it from the few data available, as well as from some intelligent ignorance derived from a study of failures. The conditions of service to be met include severe vibrations in structures usually supported as interconnected cantilevers (in the case of the collector ring and some liquid-cooled in-line applications) or as cantilever tubes or shapes (in the case of stack-type exhausts). On engines of 1000 hp. and more, temperatures of 1000 deg. F. to 1700 deg. F. are found in these structures. Hot exhaust gases pass along the inside at relatively high velocities, while rain and sea atmosphere are frequently on the outsides of the pipe system.

Under such service conditions it appears that titanium-stabilized 18-8 stainless meets all the requirements for most installations although there are some places where titanium-stabilized has failed and columbium-stabilized has done the job. The statement holds with the proviso that the welding is adequate and that the steel structure is free from zinc, and with the reminder that high-powered engines for combat service and long distance transport are being considered here.

For the larger portion of designs titanium-stabilized (Type 321) steel does the job well although there are cases where columbium-stabilized

Discussion on Exhaust Metallurgy Problems

Dr. A. L. Klein, Consulting Engineer, Douglas Aircraft Corp., Santa Monica, decried the fact that manifolds in current use by Douglas required approximately twice as many man hours to install on the airplane as the man hours, translated from dollars cost, required to produce the manifold. He advanced the opinion that an attack on this problem should be made, and spoke of the necessity for discovering materials capable of handling even higher operating temperatures than those found to exist at present, because of the increase of engine horsepower likely to take place due to development activities of the engine manufacturers and the need for higher performance aircraft. As an alternative to the necessity for finding more highly heat- and corrosion-resistant alloys, Dr. Klein suggested that an exhaust system could be deisgned with heat transfer characteristics along the lines of an engine cylinder in which the heat might be conducted away from the material of the exhaust system, thus eliminating the necessity for further worry concerning the alloy problem.

Max Tatman, Metallurgist of Consolidated-Vultee Aircraft Corp., questioned the significance of short-time tensile tests in connection with making choices of exhaust system materials and thought that creep data would be of greater value for this purpose. He asked for the reasons why 18 per cent chromium-10 per cent nickel austenitic steels were used in connection with forming practice and asked for comment as to whether a higher nickel content had been considered. Information was requested concerning the operations used for the removal of zinc from stampings prior to annealing and for information concerning what welding processes are in current use in exhaust system manufacture and comparative data for these processes as to metallurgical results and economy.

Dr. V. N. Krivobok, Chief Metallurgist of Lockheed Aircraft Corp., discussed the loss of titanium from Type 321 steel during welding operations in which the welding operators had not been trained to compensate for this phenomenon and pointed to the fact that columbium is better retained in Type 347 steel during welding operations. He also proposed as a method of test for manifold materials the intermittent heating and cooling thereof over—say about 1000 hr., in order to fully develop in the material under test its reactions to severe heating and cooling stresses as well as its resistance to oxidation and combustion gases.

In connection with the hypothesis that boron acts as a hardening agent in the welding of stainless steels, the low solubility of boron in the weld melt was pointed out and the opinion was expressed that possibly the boron found in such welds might be present as minute inclusions in the weld structure.

The author's concluding remarks pointed out that an exhaust system is an engineering structure, and when an engineer designs a structure he usually first determines the magnitude of the loads which are to be applied thereto. In the case of aircraft exhaust systems such a proceeding has rarely been possible and data on loads are non-existent, so that at the outset experience in designing such structures is an important factor in their successful operation, as well as in the application of materials. Much research work is being done currently on materials better able to operate under severe conditions of vibration and elevated temperatures, which is not available for discussion at the present time due to its restricted nature. The availability of critical alloying elements in quantity has a bearing upon this situation of developing new desgns. In attempting to evaluate materials for exhaust systems, short-time tensile, creep, stress-rupture, elevated temperature, impact, and endurance data are considered, together with the experience with a given material as demonstrated by service in such applications as oil field refinery apparatus, central power station equipment, and steam turbines; also, internal combustion turbines.

It was explained that the experiments with zinc embrittlement were conducted beginning with a temperature slightly above the melting point of zinc die-casting alloy by immersing therein stainless steel strips, upon which attack occurred to a severity varying with the time of immersion. Experiments were continued up to the temperatures indicated by the paper.

The nickel content of the steels under discussion (Types 321 and 347) is held at approximately 10 per cent because it is found that this is sufficient to keep the austenite stable during severe cold-working operations, such as drop-hammer or press forming. To increase the nickel content would require greater amounts of nickel with no particularly significant results achieved.

Oxy-acetylene, metallic arc, atomic-hydrogen arc, and helium arc-welding, as well as electric-resistance welding, all are used successfully in the various stages of exhaust system manufacture. Processes other than oxy-acetylene have the advantage that carburization due to the welding gases themselves is not a problem.

Exhausts

By H. A. CAMPBELL
Solar Aircraft Co.

. . . Performance and fabricating technique for titanium or columbium-stabilized stainless steel. Also data on elimination of cracking of the welds, with particular reference to the use of boron-containing compounds in the welding flux. This article is re-written from a report recently presented before the Southern California section, SAE.

(Type 347) steel is applied because of its higher values of yield and tensile strengths. Type 347 costs more than Type 321; 347 is somewhat harder and more expensive to work due to faster work-hardening than 321, and in the majority of flying high powered jobs, 321 is giving satisfactory service. Thus, 347 "accident insurance" is often not necessary. Even in cases where the operating temperature is such that columbium-stabilized steel seems called for, gain in over-all service life of the complete exhaust system and its shrouding may possibly result from better cooling of the system. A well done cooling job could permit the use of the cheaper steel. Under current conditions, short ferro-columbium supplies make the use of Type 321 steels a conservation measure also.

Carbide Precipitation

A few early failures of exhaust system parts were attributed to intergranular corrosion from carbide precipitation, a phenomenon discussed by Bain, Aborn, and Rutherford[3] in 1933, and suggestions are heard still that present day failures are due to this same phenomenon. A sample of a stabilized material is tested for sensitivity to intergranular attack by heating 2 hr. at 1200 deg. to 1250 deg. F., then subjected to a boiling copper sulfate-sulfuric acid solution for 48 hr. and subsequently examined. Intergranular attack is not revealed unless carbon in an amount greater than that for which the material was stabilized has been added to the constitution by faulty processing or otherwise. Under conditions of exhaust system service some part or parts of the system will be operating in this so-called sensitization temperature range which naturally produces an agglomeration of titanium or columbium carbides or cyanonitrides. In one instance, the appearance of a section taken from an exhaust system[4] made from Type 321 steel, which was in service approximately 3000 hr. and which was retired after it could no longer be repaired in the field, suggested that much carbon was present, but the test described revealed no intergranular attack on this material below the surface. It would appear, therefore, that in material in which titanium is present to the extent of at least four times the carbon content, or in which columbium is present to the extent of at least eight times the carbon content and to which carbon has not been added during the processing of the product, there is little to fear from carbide precipitation leading to intergranular corrosion and subsequent failure of the part.

Products of combustion in exhaust gases usually appear as carbon dioxide, oxygen, carbon monoxide, hydrogen, methane, together with nitrogen, with traces of oxides of lead.[5,6] These substances usually cause no immediate structural troubles in exhaust systems because of attack of the steels. In the cases of severe failures examined in detail over the past three years, no evidence of intergranular corrosion was found, due to the material constitution as such, although two cases have appeared in which the effects of welding gave rise to such attack.

Of course, if during a welding operation the weld is carburized because of excess acetylene in the welding flame or if a carbon-bearing substance such as shellac is used on a seam or other joint, as a vehicle for welding flux, carbon is then dissolved in the weld zone and may give rise to trouble.

A stabilizing heat-treatment consisting of holding the material at 1550 deg. to 1650 deg. F. for 2 hr., more or less, has been used where it is desired to establish the maximum possible resistance to inter-granular corrosion in some specific media. In exhaust systems, however, this stabilizing heat-treatment appears to be unnecessary, as there seem to be no media encountered under service conditions so highly corrosive as to require the establishment of such maximum resistance. Stabilization in this sense is believed to occur, to some degree in any case, from exhaust collector service over lengths of time at which the structure is held at temperatures ranging from 1000 deg. to 1600 deg. F.

Welding of Thin Sheets

Cracking of welds in thin stainless steel sheets such as are used for the fabrication of exhaust systems often becomes a very annoying problem, especially during the training of new welders. In an investigation of this subject started long ago, it was found that in addition to the ever-present variables of welding heat, flame adjustment, and fitting of the joint, the constitution of the welding flux itself plays an important part. Experimentation seems to indicate that the quantity of boron-containing compounds in the welding flux is capable of influencing the tendency of butt welds and edge welds to crack either immediately following welding during repair, or after the pipe section has been allowed to stand for several days after welding.

Eight groups of butt welds were prepared using conventional welding techniques in which the flux constitution was very carefully controlled. All welding was done by the same operator on about 100 samples. The welds exhibited tendencies toward brittleness as the borax and boric-anhydride constituents increased in the constitution of the flux and these two substances are found in many stainless steel welding fluxes. After the welding flux constitution was put under rigid control with respect to these compounds and with respect to the slagging constituents, much less trouble was evident with new welders and the volume of repair welding was cut in half. The flux being used currently is compounded to be mixed with methanol under close control of particle size and is kept continuously agitated so that the resulting paste

is very smooth and uniform in consistency.

The results appear explainable on the basis of work in 1932, concerning the effects of boron on austenitic chromium-nickel steels, by Bennek & Shafmeister[7] who showed that about 0.5 per cent boron added to 0.15 to 0.16 per cent carbon, 18-8 steels would produce precipitation hardening effects sufficent to increase the Brinell hardness from 150 to 205 up to as high as 315 to 317 following a water quench from 2100 deg. F. and prolonged heating at 1290 deg. F. Cornelius[8] in 1939 reported a study of six groups of steel among which was 18-8, containing 0.9 to 1.5 per cent of boron which exhibited similar behavior. Boron is in wider use today as a hardening element for steels than formerly, due to war conditions, a fact which turned attention in this direction during the investigation of the cracking problem. While the hypothesis may be completely wrong in the case of the 18-10 steels customarily used, it is thus far the explanation which seems to fit circumstances best. Certain it is that since the institution of flux control as above described, the welding results have improved and new welders find their work more easily controlled.

Effects of Zinc Alloys

In the course of the cracking investigation mentioned, it was discovered that bits of zinc alloy from drop hammer dies could also produce cracks in stainless during the annealing or other heating operation if the bits of zinc were allowed to remain on the metal surface; this is no new knowledge as the point was brought out by Anderson· Edmunds, and Siller[9] in 1940 in an A.I.M.E. paper "The Action of Molten Zinc Alloys on Pressure Die-Casting Equipment," and again by Henry and Schroeder[10] in 1942 in their A.W.S. paper, while in 1939 a private report[11] of the Carnegie-Illinois Steel Corp. metallurgical department set forth pretty much the same knowledge. The die-casting industry has known for some time that zinc alloys will dissolve the iron of the melting pot. It was thought, however, that cracking of this sort had been confined to the factory but several failures in the field showed otherwise, and there appeared to be cause for some alarm when it was decided recently by national production authorities to substitute zinc for cadmium plating on aircraft bolts, many of which are used in exhaust systems. In view of the evidence developed with the cooperation of manufacturers and others, it is hoped that the use of cadmium for such bolts will be ordered in the near future as it is possible that an exhaust system may fail because of the presence of zinc, thereby putting an aircraft out of service. Investigation shows that no attack is evident on the surface of Type 321 stainless after 10 min. contact with molten lead at 1950 deg. F. Still no attack is evident on the surface of the same steel after 10 min. in contact with molten cadmium at 1950 deg. F. Nor is any attack evident if the steel is held in contact with molten lead and molten cadmium for two hours at 1500 deg. F. With zinc the story is different. A surface of stressed stainless after contact with molten zinc at 1350 deg. F. for even a very short time, on the order of minutes, shows very evident attack· helping to show why cadmium plated bolts rather than zinc plated ones should be used in exhaust systems.

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Black Finishes for Ferrous and Non-Ferrous Parts

A VARIETY of war production items of brass and copper, zinc, cast iron and steel are being black finished by the Oxidine finishes and Jetal process of the Alrose Chemical Co., Cranston, R. I. Oxidine B is an adhering hard black usable on alloys such as brass and electroplated copper and brass. No special equipment is needed; the salts are merely added to water, heated to 200 deg. F. and the black is obtained by immersion in the bath for 3 to 15 min., depending on the alloy. Work can be handled in bulk. Oxidine B is used for blackening and protection of instruments, optical goods, ordnance parts, and many other applications.

For zinc, Oxidine Z is recommended. It is satisfactorily used on zinc die castings and electroplated zinc. Only simple equipment is required, the process calling for the addition of the salts to water, heating to boiling point and immersion of the objects from ½ min. to 2 min.

On cast iron, Oxidine CI provides an inexpensive and simple method of obtaining a dense black finish at low temperature. The salts are added to water and heated to 212 deg. F., after which the cast iron parts are immersed for 5 to 10 min. No special cleaners are required, and the application can be made to a great variety of cast iron parts with equal speed and facility.

For steel, the Jetal process produces a deep penetrating black by a 5 to 10 min. immersion in a bath prepared by adding the salts to water and heating to 285 deg. F. When the Jetoil process is applied as an after finish, the surfaces so treated will withstand 25 to 300 hr. of salt spray by test, depending on the oil used.

Smelting of Vanadium-Bearing Titaniferous Sinter

. . . The presence of vanadium in large New York State deposits of titaniferous magnetite has prompted a Bureau of Mines investigation of the smelting of titaniferous sinter. This report of the Bureau's experiments indicates that oxides of vanadium are reduced readily under blast furnace conditions and that no difficulties are encountered in producing slag containing about 10 per cent TiO_2 operating on 25 per cent sinter.

UNTIL recently the availability of nontitaniferous iron ore has left little incentive to use ore containing titanium, but the presence of vanadium in certain deposits of titaniferous magnetite in New York State has created new interest in problems connected with the use of titanium-bearing ore. It appears that most of the vanadium in this ore can be recovered in pig iron, which can be blown in a converter to produce a slag containing vanadium in amounts suitable for the production of ferrovanadium.

This New York deposit, known as the Sanford ore, is one of the largest deposits of iron-bearing material east of the Lake Superior region and is being mined by open-pit methods. (See "Titaniferous Adirondack Ores Being Reworked" by F. J. Oliver, THE IRON AGE, March 5, 1942). Although methods for utilizing the titaniferous magnetite have not been fully explored, this material represents a substantial source of iron, as well as a large potential source of vanadium.

An investigation of the smelting of titaniferous sinter for the recovery of vanadium has been made by the Bureau of Mines, the National Lead Co. and the University of Minnesota, at the request of the WPB. The investigation consisted primarily of a test made in a 6-ton experimental blast furnace at the University of Minnesota Mines Experiment station, the purpose of which was to obtain information on the effect on TiO_2 upon furnace operation, particularly upon the character of the slag.

It is well known that TiO_2 is a slag-forming material that will increase the amount of slag produced by the usual gangue materials, silica and alumina. Increase in the volume of slag due to the presence of TiO_2 and a lack of information concerning its effect on the properties of the slag have prevented the general use of titaniferous ore. Also a common belief among furnace operators that the bottom of the furnace builds up when ores containing TiO_2 are smelted has militated against the use of titaniferous ore. This building up of the hearth has been attributed to the formation of copper-colored crystals of titanium cyanonitride, which have been observed in the salamanders of blast furnaces.

The effect of TiO_2 on the character of the slag is especially important, because the proportion of vanadium-bearing sinter that can be used with nontitaniferous iron ore depends on the amount of TiO_2 that can be present in the slag without interfering with normal operation. It would be desirable, of course, to use the largest possible proportion of sinter to obtain a higher percentage of vanadium in the pig iron. The TiO_2 content of a workable slag indicates the extent to which the slag volume may have to be increased to dilute the TiO_2 effectively.

A recovery in the metal of 87.3 per cent of the vanadium was obtained during the operation of the experimental blast furnace on burdens composed of iron ore and titaniferous sinter containing 11.1 per cent TiO_2 and 0.26 per cent vanadium. Approximately 4 per cent of the vanadium was lost in the slag. These results show that the oxides of vanadium are reduced readily under blast-furnace conditions.

With essential features of operation approximately constant, the proportion of sinter in the burden was varied from 25 to 100 per cent. The TiO_2 in the slag produced during three periods of operation on 25 per cent sinter averaged 7.6, 10.0 and 10.5 per cent. No difficulties were encountered in producing slag containing about 10 per cent TiO_2. The tuyeres remained free of slag, blast pressures were uniformly low, and the slag drained readily from the iron notch.

Burdens composed of 53 per cent sinter and 47 per cent high-grade hematite produced slags averaging 16.8 per cent TiO_2. The operation during this period was not as satisfactory as it was when the slag contained about 10 per cent TiO_2. Much higher blast temperatures, which are available in commercial furnace practice, and greatly reduced losses of heat from the crucible probably would overcome the difficulties encountered during the operation of the experimental furnace on slag containing 15 to 20 per cent TiO_2.

The TiO_2 in the slag from all-sinter burdens ranged from 20.0 per cent in a basic slag to 30.7 per cent in a more acid slag. As the major conditions of operation were essentially the same throughout the run, except for the higher TiO_2 content of the slag on all-sinter burdens, comparative results from the experimental-furnace run indicate that slag containing TiO_2 in excess of 15 per cent causes more difficulties in the hearth, in the combustion zones, and in the bosh. Slag

(CONTINUED ON PAGE 131)

Salt Bath Heat Treatments

for Emergency Steels,

Translated by E. I. VALYI
Samtour & Co., Inc.

. . . German metallurgists, coping with shortages, have found that salt bath heat treating can eliminate decarburization and scaling difficulties, and susceptibility to slight changes in the heat treating cycle resulting from chromium content in the absence of nickel. Some of their practices and equipment are here described.

IN the past few years, German steels containing nickel have been almost completely eliminated, necessitating the development of new heat treating methods, says a recent issue of the Swiss journal, "Schweizer Archiv" in an article on electric salt bath heat treatment of steel containing reduced amounts of strategic alloying elements.

At first chrome-molybdenum emergency steels were used. These were finally abandoned in favor of chrome-manganese steels which are in wide use at present. Table I shows analyses and properties of chromium-manganese carburizing and hardenable steels.

The chromium content in the absence of nickel imparts certain properties to the steels that have to be watched: They scale and decarburize more readily; they are increasingly susceptible to overheating and uneven timing cycles; in the case of the carburizing steels, excess massive retained chromium carbide may occur in the case, particularly with comparatively heavy case depth, with an adverse influence on the mechanical properties of the case.

Difficulties with regard to recarburization, scaling and susceptibility to slight changes in the heat treating cycle can best be eliminated by the use of salt bath methods. Carburizing is also preferably carried out in salt baths. In the case of a heavy case, salt bath carburizing can be followed by diffusion treatment, thus controlling the carbon content of the case. Extraordinary accuracy can be achieved this way with regard to carbon distribution.

All the baths used are of the cyanide type, both for carburizing and for hardening and drawing. The cyanide content is of great influence on the type of the furnace.

The furnaces described are covered by German patents Nos. 589,824 and 621,539. They contain electrodes placed very close to the container wall. The current passes within the small space between electrodes and container wall. The rest of the container volume available for work is practically free of electric flux. The current input remains practically constant even if work of very sizable dimensions is charged. The electrodes are preferably arranged at very short intervals along one of the longer walls of rectangular containers. Ideal

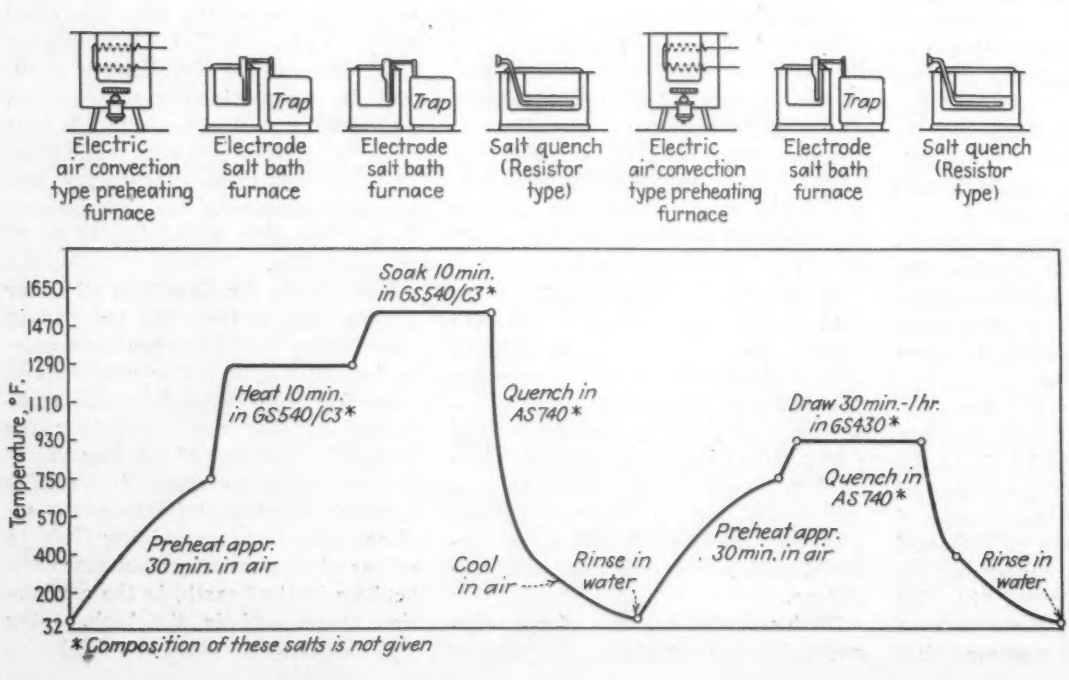

FIG. 1—Schematic representation of the heat treating cycle. In the case of small quantities and simple work, the first salt bath furnace can be omitted.

temperature distribution is achieved in this way. This arrangement of electrodes appears to be very favorable from the standpoint of avoiding decomposition of cyanide baths, even if they are operated at temperatures not much below the decomposition temperature. One furnace of this type contains three electrodes connected to a transformer. The bath operates at 8 to 16 volts. This electrode arrangement permits use of practically all the container space for work. The furnace is automatically controlled and will maintain temperature within plus or minus 4 deg. F. or at most 6 deg.

Furnaces up to 6 ft. in depth have been built and operated successfully. The crucibles last for 3000 hr. of continuous operation at 1700 deg. F. Steel containers are used.

The following heat treating cycle is used with salt bath furnaces for the heat treatment of emergency steels: Harden at approximately 1600 deg., quench and draw at approximately 600 deg. to 900 deg. F. as required. Carbon steels are quenched in water or oil, alloy steels in oil. Quenching in molten salt at approximately 400 deg. F. shows great advantages over oil quenching, since it reduces cracking and warpage approximately 50 per cent. The salt quench bath is electrically heated. The temperature increase due to immersion of work is compensated for by cooling, in the case of small furnaces with air, in the case of larger furnaces with water. In one salt quenching furnace of this type the heaters are of the submerged type. Cooling is done by water jackets. Heating and cooling are automatically controlled.

In addition to the salt quench furnaces, air convection preheating furnaces are also used, bringing the work to approximately 500 deg. to 800 deg. F. prior to hardening, that is prior to transfer into the salt bath furnace.

Fig. 1 shows a schematic representation of the heat treating cycle. The first salt bath furnace operating at 1300 deg. F. can be left out in the case of small quantities and comparatively simple work; however, danger of warpage increases if this is done.

Fig. 2 is a schematic layout of an automatic heat treating installation to carry out the aforementioned cycle. The work is carried by a rotary fixture, the arms of which also contain the ducts for the salt bath vapor exhaust. The work is moved by lifting, turning and lowering of the fixture; the fixture is controller automatically by an electric timer.

Greatest possible uniformity of structure and hardness as well as extreme dimensional precision can be achieved. Changes in dimensions are reduced to a minimum and remain uniform for all pieces; therefore, they can be reckoned with in designing. The method here described results in highly improved wear resistance in the case of gears.

Carburizing is usually carried out at 1700 deg. F., lasting 1 to 6 hr., depending upon case depth required. Fig. 3 shows a plot of case depth against time. In the case of a long cycle, massive chromium car-

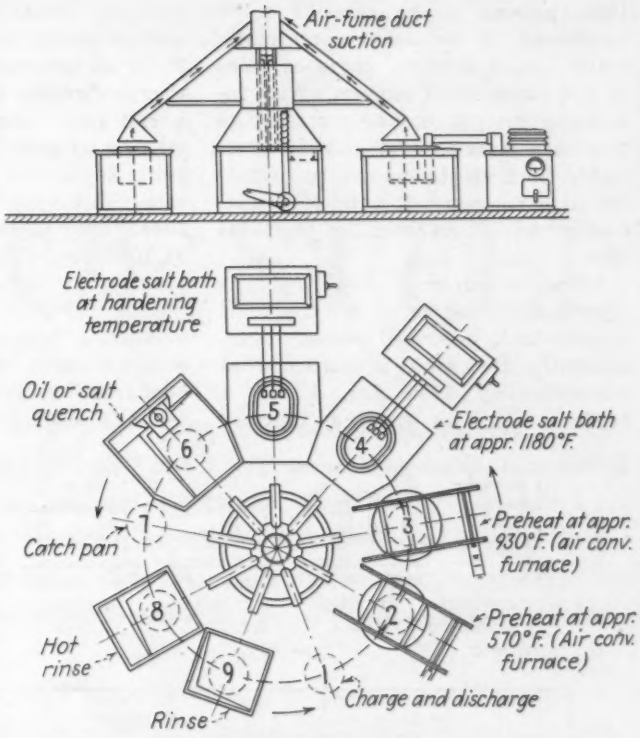

FIG. 2—Schematic layout of an automatic heat treating installation to carry out the heat treating cycle represented in Fig. 1.

TABLE I

Carburizing Steels, Composition in Per Cent

Type	Carbon	Manganese	Silicon	Chromium	Molybdenum
EC 80	0.12–0.17	1.10–1.40	0.20–0.35	0.80–1.10	.....
EC 100	0.18–0.23	1.20–1.50	0.20–0.35	1.20–1.50	.....
ECMO 200	0.17–0.23	1.20–1.50	0.20–0.35	1.70–2.00	0.15–0.25

Tensile Strength, as Hardened*

Diameter, In.	Lb. Per Sq. In.	Lb. Per Sq. In.	Diameter, In.	Lb. Per Sq. In.
0.4	157,000 to 200,000	200,000 to 242,000	1.2	171,000 to 214,000
0.8	135,000 to 171,000	171,000 to 220,000	2.4	157,000 to 200,000
1.2	121,000 to 157,000	157,000 to 205,000	3.6	142,000 to 185,000

Heat Treating Steels, Composition in Per Cent

Type	Carbon	Manganese	Silicon	Chromium
VM 125	0.28–0.35	1.20–1.50	0.20–0.35	.....
VMS 135	0.35–0.40	1.10–1.40	1.10–1.40	.....
VMC 140	0.35–0.43	1.00–1.30	0.50–0.80	1.00–1.30

Tensile Properties

Diameter, In.	Tensile Strength, Lb. Per Sq. In.		
	VM 125	VMS 135	VMC 140
2.4	93,000 to 114,000	114,000 to 135,000	135,000 to 157,000
4	93,000 to 114,000	107,000 to 128,000	128,000 to 150,000
6	85,000 to 107,000	100,000 to 121,000	114,000 to 135,000
8	85,000 to 107,000	93,000 to 114,000	114,000 to 135,000

* No indication as to the types in this table are given in the original paper

bides appear in the case as above mentioned. If the case does not materially exceed 0.04 in., these carbides do not cause much concern. With increasing case, it may be necessary to eliminate them by further heat-treatment. Such treatment can be carried out in a further salt bath of special composition at carburizing temperature.

After carburizing, the work is quenched, preferably in the salt quench bath described above. Subsequently, the work is hardened at approximately 1500 deg. F. in a further salt bath furnace, followed by final quench in a salt quench bath. In many instances, core hardening has to be added to this cycle.

A complete carburizing cycle consisting of preheating, carburizing, diffusion, salt quench, preheating, hardening and salt quench is shown in Fig. 4. Due to the long carburizing cycle, automatic devices such as those shown in Fig. 2 are hardly practical except in the case of very large quantities.

In the case of emergency high speed steels, alloying constituents have been considerably reduced. After some use of tungsten-molybdenum steel, the following low-tungsten composition was arrived at: C 1.35, V 4.30, Cr 4.25, Tu 11.50, Mo 0.90.

This steel is more susceptible to differences in heat treatment than the steels previously used and also shows greater tendency to decarburize. All difficulties were overcome by the use of suitable salt baths.

Heat treatment is carried out at a temperature of 2372 deg. F. in high temperature electrode furnaces, refractory lined. The cycle is best carried out by preheating to 750 deg. F. in an air-convection furnace, further preheating up to 1650 deg. F. in a salt bath furnace containing salt melting around 1300 deg. F. Hardening is carried out in an electrode salt bath furnace at 2372 deg. F., followed by quenching in a salt bath at 1076 deg. F. (salt melting at approximately 800 deg. F.). After air-cooling, the steel is drawn in the last mentioned "quenching" bath. Fig. 5 is a schematic representation of the heat treating cycle of emergency high speed steels. This method of heat treating is generally used and permits elimination of decarburization, cracks and undue warpage of tools.

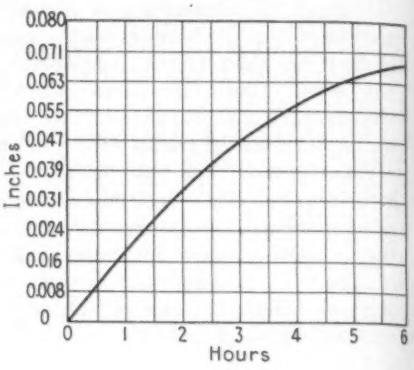

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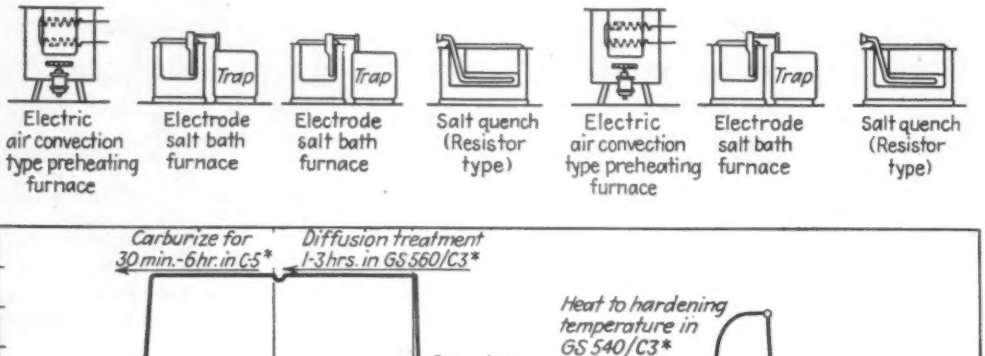
FIG. 3 — Depth of case as a function of carburizing time at 1700 deg. F. Steels used were EC 80, EC 100 and ECMO 200 (see Table I). Composition of bath not given.



* Composition of these salts is not given

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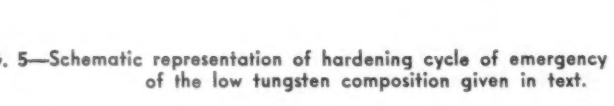
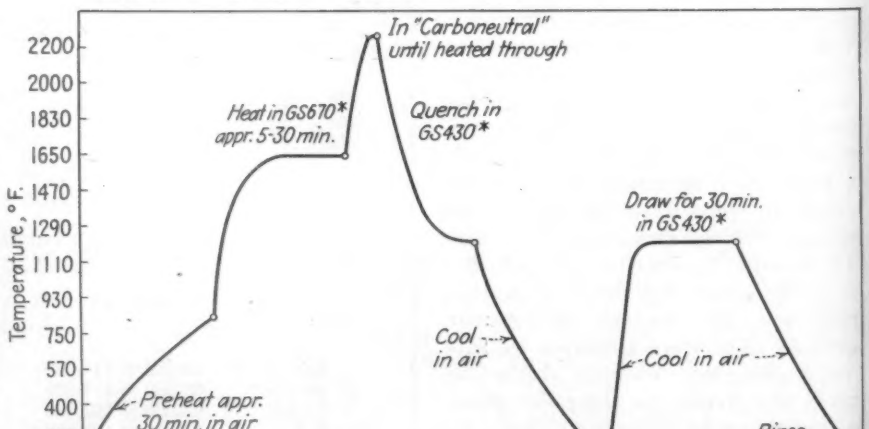
FIG. 4—Schematic representation of carburizing cycle.

FIG. 5—Schematic representation of hardening cycle of emergency high speed steels of the low tungsten composition given in text.





* Composition of these salts is not given

Guide for the Selection of

TOOL STEEL

. . . The characteristics of the steel used almost exclusively for cutting tools are first discussed and the general applications to which these steels are suited are indicated. The author then similarly analyzes the specifications of steels that are used primarily for other than cutting tools. Suggested steels for specific applications and their working hardness are given in a comprehensive table.

o o o

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THERE are available today a large number of tool steels which are likely to cause confusion in selecting steel for specific jobs unless one is conversant with the general types into which such steels may be classified. Several advantages, particularly for a comparatively large tool shop, will accrue by coordinating tool steels according to types. Raw steel inventories are decreased, the same working characteristics are obtainable from various sources, and tool makers and designers are much more likely to make use of the characteristics of the steels.

This guide is based upon such a classification of 12 steel types which have been found to be adequate for over 95 per cent of the jobs manufactured by our tool and die shop. Specifications which simply coordinate the various brands are issued and the steel is procured and stocked accordingly. These steels are shown in Table I. It is emphasized that all of the types available today are not included, but these steels produce the necessary variety of properties required. The other materials utilized include cemented carbides, hot work steels, prehardened, and the graphitic steels.

TABLE I

Spec. No.	Type
1	18-4-1 high speed steel
2	6-6-2 high speed steel
3	18-4-1 cobalt high speed
4	6-6-2 cobalt high speed
5	14-4-2 cobalt high speed
6	water hardening tool steel
7	Oil hardening tool steel
8	High carbon, high chromium steel
9	Silico-manganese chisel steel
10	Chromium air hardening steel
11	Zinc-base die casting die steel
12	Aluminum-base die casting die steel

In general, the application of the various tool steels for specific jobs are dependent upon one or more of the following factors:

Wear resistance
Cutting ability
Hardening characteristics
Toughness
Hardness
Machinability.

The different tool steels have, as a rule, been developed to include those of the above factors which give the most satisfactory service for specific applications. In order to simplify these factors of selection, all tool steels can be divided into two general classes namely: cutting tools and tools other than cutting tools.

I—CUTTING TOOLS

Cutting tools must combine sufficient strength to maintain a sharp cutting edge, sufficient wear resistance to prevent wearing of the cutting edge, sufficient toughness to prevent chipping of the cutting edge, and sufficient hardness to prevent picking-up of the chips. Cutting ability may be defined as a favorable compromise of these factors, and it follows that it is the prime requisite.

Modern steels for metal cutting may be divided into two groups: (1) High speed steels and (2) tungsten finishing steels.

High Speed Steels

All high speed steels are oil hardening and are little subject to warpage and breakage in heat treatment. They favorably combine the foregoing requirements for cutting ability and, are characterized by the ability to cut efficiently at elevated temperatures. It is this latter characteristic called "red hardness" which has led to the use of high speed steels for 95 per cent of all metal cutting today. The higher safe temperature of the cutting edge permits the use of greater speeds and feeds than are possible with carbon and other alloy steels.

Specification No. 1
18-4-1 *High Speed Steel*

Carbon	0.70	per cent
Tungsten	18	" "
Chromium	4	" "
Vanadium	1	" "

Commonly called "18-4-1," this is a general purpose steel which possesses excellent ability to maintain a cutting edge. It may be used quite satisfactorily for all types of cutting tools.

Years of experience have shown that this composition results in the most satisfactory all-purpose cutting steel. Increasing the tungsten content above 18 per cent gives better cutting efficiency but a greater degree of brittleness. Decreasing the tungsten results in greater toughness but at a sacrifice in cutting efficiency. For much the same reasons the chromium content is held at 4 per cent. Vanadium increases the cutting efficiency. When present in amounts much above 1 per cent, however, brittleness is increased. Increasing the carbon above 0.75 per cent gives less toughness, and lowering the carbon increases the toughness with a sacrifice in cutting ability.

This steel is quite foolproof in heat treatment; it does not tend to decar-

burize, nor is it sensitive to mild overheating. The current base price is 67c. per lb., and extras are added to this on a pound basis for such factors as weight of orders, sizes, lengths, etc. Inasmuch as these extras are the same for the various high speed steels, the base price may be used for relative cost figures.

Specification No. 2

6-6-2 *High Speed Steel*

Carbon	0.80	per cent
Tungsten	5.5	" "
Chromium	4	" "
Vanadium	1.5	" "
Molybdenum	5	" "

This 6-6-2 steel is a recent addition to the high speed steels, and the analysis is similar to the 18-4-1 type except that a considerable amount of the tungsten has been replaced by approximately 5 per cent of molybdenum. This latter element is more effective than tungsten in conferring red hardness properties to steel and thus not as much is required as the amount of tungsten displaced.

The 6-6-2 type is an all-purpose steel and is used interchangeably with 18-4-1. It is not as foolproof in heat treatment due to a tendency for decarburization and sensitivity to overheating, but in a modern hardening room this is not a factor for consideration in selecting this steel. Although not as much experience is behind the 6-6-2 type, it is rapidly replacing the 18-4-1. For most applications it performs at least equally as well and the current lower base price of 57c. per lb. is attractive.

Uses of Specs. Nos. 1 *and* 2: Cutters of all kinds.

Specification No. 3

18-4-1 *Cobalt High Speed Steel*

Carbon	0.75	per cent
Tungsten	18	" "
Chromium	4	" "
Vanadium	1.5	" "
Cobalt	5	" "

This may be considered as 18-4-1 with 5 per cent of cobalt added. The cobalt confers additional red hardness properties to the steel, but renders it more brittle. Other steels containing up to 12 per cent cobalt are occasionally used, but they are not covered by specifications due to their restriction to a few specific jobs. The greater the cobalt content, the greater the red hardness and the less the toughness.

Cobalt high speed steels are well adapted for hogging cuts on abrasive materials which develop high frictional temperatures or for other cuts where the temperature of the cutting edge is greatly increased. It does not hold a keen edge as well as the other types, and thus is not well adapted for finishing cuts. These steels are more expensive than the non-cobalt types, the current base price ranging from $1.10 per lb. for the 5 per cent type (Spec. No. 3) to $2.42 per lb. for the 12 per cent cobalt grade.

Specification No. 4

6-6-2 *Cobalt High Speed Steel*

Carbon	0.85	per cent
Tungsten	5.5	" "
Chromium	4	" "
Vanadium	1.5	" "
Molybdenum	5.5	" "
Cobalt	5	" "

This may be considered as equivalent to the 6-6-2 type with 5 per cent of cobalt added to confer increased red hardness properties. Here, as in the case of the 18-4-1 cobalt types, the toughness is decreased.

This is a recent addition to the high speed steels and it is used interchangeably with the 18-4-1 cobalt (Spec. No. 3) since the two steels possess the same characteristics. The present base price for this grade is $1.10 per lb.

Uses of Specs. Nos. 3 *and* 4: Lathe tools, heavy duty cutters, boring tools, gun barrel drills for heavy and roughing cuts. The expense of these steels, particularly the higher cobalt variations of 18-4-1 cobalt, justify their use only if experience clearly indicates definite superiority for a specific job by actual tests.

Specification No. 5

14-4-2 *High Speed Steel*

Carbon	0.7	per cent
Tungsten	14	" "
Chromium	4	" "
Vanadium	2	" "

This steel is well adapted for use in turning and boring tools. The lower tungsten content as compared with 18-4-1 results in increased toughness. Here again the cobalt enhances service life for cuts where the temperature of the cutting edge is greatly

TABLE II

Tool Steel Selection Guide

Application	1st Choice	2nd Choice	3rd Choice	Recommended Hardness Rockwell "C"
Arbors	9	6	MS-Carb.	45–50
Boring bars	9	6	MS-Carb.	59–62
Boring tools, finishing	1,2	3,4		63–65
Boring tools, roughing	3,4	5	1,2	62–64
Broaches, burnishing	1,2	8	7	64–66
Broaches, roughing	1,2			62–65
Bushings, drill	8	10	7,6	63–66
Center drills	1,2	6		62–64
Centers	1,2	8	6	60–62
Center punches	9	6		58–60
Chasers	1,2	7	6	60–63
Chisels, cold	9	6		56–58
				Shank—45–50
Chuck jaws	MS-Carb.	7	6	58–60
Collets	9	6	7	58–60—Head
				45–50—Tail
Counterbores	1,2	6		62–64
Countersinks	1,2	6		62–64
Cutting-off tools	1,2			63–65
Dies, coining	8	10	7	61–63
Dies, die casting aluminum base	12			44–50
Dies, die casting zinc base	11	12		44–50
	For dies where wear resistance is most important No. 11 is cased in activated cyanide, and No. 12 is heat treated to Rockwell "C" 56–58.			
Dies, blanking and stamping	8	10	7	61–63
Dies, embossing	8	Fast Fin.	10	61–63
Dies, stripper	10	7	6	48–52
Dies, threading machine	See Chasers			
Dies, cold trimmer	8	10	6	58–60
Dies, hot work	Special Hot Work Steels			
Dies, drawing	8, Fast Fin.	10,7	6	62–64
Draw punches and rings	8	10	7	62–64
End mills	1,2			62–65
Fixture blocks	MS-Carb.	10,7	6	60–62
Forming tools	1,2	7	6	63–65
Gages, long plug	MS-Carb. or 6 Chrome plated*	8,10,7		63–66
Gages, ring	8, Fast Fin.	10	7,6	63–66
Gages, short plug	MS-Carb. or 6 Chrome plated*	8,10,7		63–66

Application	1st Choice	2nd Choice	3rd Choice	Recommended Hardness Rockwell "C"
Gages, Th'd-Outside to be ground	8	10	7,6	63–66
Gages, thread ring	7	10	.....	63–66
Gages, snap	Carbide inserts in MS	8	10,6,7	63–66
Grubbing tools	1,2	6	.....	58–61
Gage blocks	10	7	.....	62–65
Hobs	1,2	10,7	6	62–65
Hollow mills	1,2	10,7	6	62–65
Inletting tools	1,2	7	6	56–60
Jig blocks	MS-Carb.	10,7	6	60–62
Knives, wood cutting	1,2	7	6	58–60
Lathe tools, finishing	1,2, Fast Fin.	6	.....	64–66
Lathe tools, roughing	3,4	5	1,2	62–65
Locating blocks	MS-Carb.	10,7	6	60–62
Mandrels, long	MS-Carb. or 6 Chrome plated*	10	7	60–63
Mandrels, short	MS-Carb. or 6 Chrome plated*	6	.....	60–63
Marking tools	9	6	.....	60–62
Milling cutters	1,2	.....	.....	62–65
Milling cutters, circular form	1,2	.....	.....	62–65
Milling cutters, shank type	1,2	.....	.....	61–64
Profile cutters	1,2	.....	.....	61–64
Profile former pins	MS-Carb. or 6 Chrome plated*	6	.....	60–62
Profile former plates	10	7	6	62–65
Punches, cold (staking, etc.)	9	6	.....	58–60
Pilots (counterbores, etc.)	8	6	.....	60–63
Reamers	1,2	.....	.....	62–65
Reamers, hand	Fast Fin.	1,2	.....	63–66
Rifling tools	Fast Fin.	.....	.....	64–66
Screwdrivers	9	6	.....	54–57
Shaving tools	1,2	.....	.....	62–64
Spindles, hardened	9	6	MS-Carb.	58–61
Springs, large	Spring stock	6	.....	42–45
Springs, medium	Spring stock	6	.....	44–47
Springs, small	Spring stock	6	.....	46–49
Taps, large	1,2	7	6	60–64
Taps, small	1,2	7	6	58–60
Thread cutters	1,2	7	6	60–63
Vise jaws	MS-Carb.	7	6	56–60
Wrenches	9	6	MS-Cyanided File hard	42–45

* Hardness of parts before chromium plating R_c 45-50. Minimum residual chromium after grinding to be 0.001" on a side.

increased. The base price is approximately $1.10 per lb.

Uses of Spec. No. 5: Turning and boring tools.

Tungsten Finishing Steel

Tungsten finishing steel has found wide usage for finishing cuts, and although not included in the above specifications, it is mentioned here as an important type of steel. These steels are water hardening and are subject to dimensional instability, warpage and breakage in heat treatment. They are characterized by the ability to be heat treated to an extremely high hardness and by the ability to be sharpened to an extremely keen edge.

Fast Finishing Tool Steel

Carbon	1.30 per cent
Tungsten	3.5 " "

The tungsten and high carbon contents of this steel are responsible for the high hardness to which it can be heat treated. As would be expected from the analysis, it is quite brittle. Consequently, the steel finds its principal use for taking fine finishing cuts. Also because of its excellent wear resistance, it finds some use for gages where the water hardening characteristics are not detrimental. This material will successfully cut very hard material, but the speeds and feeds do not vary greatly from those used with carbon tool steel. It does not exhibit red hardness properties, as the tungsten content is not sufficiently high. The current base price is 48c. per lb. and it is subject to carbon steel extras, which are somewhat lower than the extras applied to the high speed steels.

Uses: Certain reamers, master form tools, rifling cutters, gages, draw rings and finishing lathe tools where excellent surfaces are desired.

II—NON-CUTTING TOOLS

It is this class of tools where the greatest judgment must be exercised in selecting the proper type of steel for a specific tool. Since both the tool requirements and the characteristics of the various available steels are many and varied, it is most important that these be correlated. For example, the best steel for internal thread gages from the viewpoint of service life would be high carbon, high chromium steel. However, this material machines with considerable difficulty and also "moves" slightly in hardening. Therefore, lower alloyed steels are used, these compromising wear resistance, machinability and dimensional stability.

In selecting a steel for this class of tools, the first factor to be considered should be the hardening characteristics of the steel. Since most tools must be hardened for satisfactory use, it follows that until hardened a tool is worth but little more than the scrap value of its metal.

Hardening is a drastic process and introduces large internal stresses in the tool in two ways: (1) thermal expansion and contraction upon heating and cooling and (2) expansion when the hardening transformation occurs. These changes are responsible for warpage, breakage and dimensional instability of all steels in hardening. However, the internal stresses and thus their effects can be controlled to a great extent by the type of steel selected, namely, water, oil or air hardening steel.

Water quenching is the most drastic type of quench and introduces the largest internal stresses in the tool. Hence, the danger of warpage and breakage is the greatest.

Most spoilage is the result of simple expansion and contraction upon heating and cooling. In heating, thin and thick sections heat at different rates with consequent uneven expansion. As a result, warpage upon heating may occur regardless of the type of steel. The great majority of hardening spoilage, however, occurs upon quenching. Here, a thin section adjoining a thick section cools, and thus contracts and hardens prior to the thick section. The thermal contraction of the thin section pulls on the hot and still ductile thick section and deforms it slightly. Thus warpage may occur depending upon the magnitude of the involved stresses. When the thick section cools a fraction or so of a second later, it contracts and pulls on the now cool thin section. Since the thin section is hard

and has no appreciable ductility, it may break, depending upon the magnitude and concentration of the stresses involved.

Because of the above facts water hardening steels should be used for parts of uniform contour with no abrupt changes in section mass. Such parts are designated as "simple," and include taps, drills, short plugs, certain reamers, punches and short arbors. "Complex" parts such as locating blocks, gage blocks, long plugs and vise jaws, should not be made from water hardening steels because of the danger of warpage or breakage in hardening.

At *A* in Fig. 1 is illustrated a simple part suitable for water quenching. By the introduction of the holes shown at *B* this part becomes complex due to the thin sections (indicated by the arrows) adjacent to the thick sections. At *C*, by the introduction of many equally spaced holes to give uniform sections, the part again becomes simple and may be water quenched safely from the viewpoint of breakage.

Fig. 2 illustrates good and poor tool design with regard to heat treatment and service life whether the steel be water, oil or air hardening.

A variation of the same principle accounts for warpage and sometimes breakage of parts of uniform mass. No matter how careful the tool hardener is, the part will not enter the quench bath perfectly. Accordingly, one surface will cool faster than the others, and thus contract and bend the yet plastic section. Warpage and breakage may occur, depending upon the magnitude of the stresses involved. The more rapid the quench, the greater these effects. Actually all steels—water, oil and air hardening types—warp upon quenching in accordance with the above discussion, but only when the magnitude is easily discernible is warpage designated as such.

In addition to the above, the hardening transformation of all steels upon quenching involves expansion. Water hardening steels expand considerably more than oil and air hardening steels, and thus are subject to a greater dimensional change upon hardening.

Oil Hardening Steels

Oil hardening steels contain sufficient alloying elements to develop a satisfactory working hardness when oil quenched from the hardening temperature.

Since the oil quench is much less drastic than water, the danger of warpage and breakage in hardening is greatly reduced. Moreover, the oil hardening types do not expand as much in hardening. Hence, they are classed as non-deforming.

Oil hardening steels are deep hardening due to their alloy content. As a result, they are more brittle than water hardening steels which harden with a tough core. For parts of water and oil hardening steels that harden completely through, however, the oil hardening steels are usually the tougher due to the added alloys.

Air Hardening Steels

This type of steel contains sufficient alloys to develop a satisfactory working hardness when quenched in still air from the hardening temperature. (Specification No. 10.) Inasmuch as a still air quench is extremely mild as compared to water and oil, warpage and particularly breakage are practically non-existent with this material. Moreover, air hardening steels are essentially non-deforming.

Having considered the characteristics of water, oil and air hardening steels, the next decision is to correlate the required properties of the tool with the properties of the various available steels. The steels for other than cutting tools have been developed to provide certain combinations of the factors given in Section I. Certain steels combine wear resistance and dimensional stability. Others combine toughness and wear resistance and dimensional stability. Others combine toughness and wear resistance. Others show extreme toughness with moderate wear resistance.

Specification No. 6

1.00 per cent Water Hardening Steel.

Carbon	1.00 per cent

This is a straight carbon tool steel. It is subject to dimensional instability, warpage and breakage in hardening. For this reason, it should be used only for tools of simple shape as described above. Since it contains no added alloys, it is shallow hardening and hardens with a tough core. This characteristic is its principal advantage. Another is its ability to be part quenched in water for that part of the tool which must be hard, and then to be oil quenched for that part which must be tough. The current base price is 15c. per lb. with carbon steel extras added.

Uses of Spec. No. 6: This steel should be used for parts of relatively simple shape where good wear resistance, toughness and hardness are required. Such parts include short punches, taps, certain reamers, drills and small gages. It should not be used for locating blocks, gage blocks, vise jaws and other parts of complex shape due to the danger of spoilage in hardening.

Specification No. 7

Manganese-Chromium-Tungsten Oil Hardening Steel

Carbon	0.95 per cent
Manganese	1.2 " "
Chromium	0.5 " "
Tungsten	0.5 " "

This steel has essentially the same analysis as that of steel No. 6, but with sufficient alloys added to make it oil hardening. It finds wide usage for tools of complex shape which might readily be spoiled in hardening if made of a water hardening steel.

This material has excellent dimensional stability and non-warping characteristics. The current base price is about 25c per lb. with carbon steel extras added.

Uses of Spec. No. 7: Locating blocks, gage blocks, gages and other parts of complex shape, taps and master tools, and dies for relatively low production.

Specification No. 8

High Carbon-High Chromium Tool Steel

Carbon	1.5 per cent
Chromium	12 " "
Molybdenum	0.8 " "

This is an air hardening steel which possesses an extremely high resistance to wear which is not indicated by hardness tests. Such wear resistance is due to the presence of extremely hard chromium carbides. It is difficult to machine and grind, but has found wide usage where exceptional resistance to wear and dimensional stability upon hardening are desired. The added costs of manufacturing for most applications are well balanced by the resultant increase in service life.

Uses of Spec. No. 8: Drill bushings, gages, punches, and forming, drawing, blanking and trimming dies for high production.

Specification No. 9

Silico-Manganese Chisel Steel

Carbon	0.5 per cent
Manganese	0.8 " "
Silicon	2 " "

This is essentially a water hardening steel which has been widely used as a spring steel. As is shown in the nominal analysis given herein, it contains less carbon than most tool steels. This, in conjunction with the silicon, results in a steel of exceptional toughness and resistance to repeated shock loads, coupled with good wear resistance. The current base price is about 16c. per lb. with carbon steel extras added.

Uses of Spec. No. 9: Cold chisels,

screwdrivers, punches, shear blades, short arbors, shanks for carbide tipped tools, inserts for certain forming dies.

Specification No. 10
Chromium Air Hardening Tool Steel

Carbon	1	per cent
Chromium	5	" "
Molybdenum	1	" "

This is an air hardening steel which couples good wear resistance with good toughness. Its wear resistance is about midway between the high-carbon high-chromium type (Spec. No. 8) and the oil hardening type (Spec. No. 7). It is generally considered to be tougher than these steels.

The air hardening property of this material adapts it for use where the design of the tool indicates a serious danger of warpage and breakage in heat treatment, or where excellent non-deforming characteristics are desired. The current base price is about 25c. per lb. with carbon steel extras added.

This price is very attractive for an air hardening steel and full consideration should be given to it whenever applicable.

Uses of Spec. No. 10: Long gages, locating blocks, gage blocks, punches, and forming, drawing, blanking and trimming dies for intermediate production or where steel No. 8 is not tough enough.

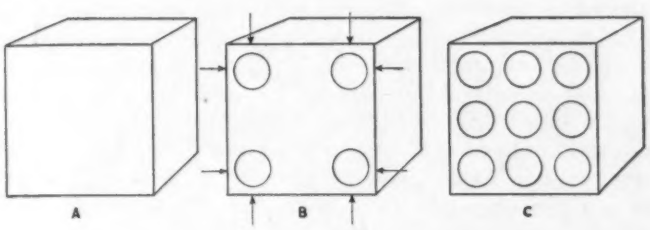
Specification No. 11
Zinc Base Die Casting Die Steel

Carbon	0.45	per cent
Chromium	1	" "

This material is a medium carbon, low chromium steel combining high strength and excellent toughness with moderate wear resistance. Such properties adapt it for use in parts which are subjected to repeated stresses or shock loads.

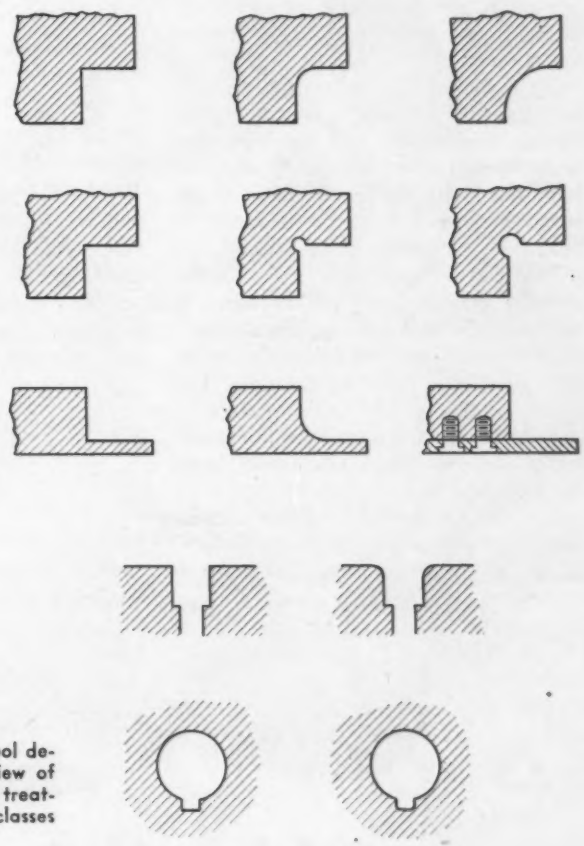
It is considered here, however, as a zinc base die casting die material. For this application it provides excellent toughness, hardness, and resistance to heat checking. Although other more highly alloyed steels will give greater production, this material possesses the advantage of weldability. It is frequently necessary to add stock due to engineering changes long before the die is worn out, and this material can be welded quite satisfactorily without danger of cracking or porosity.

Uses of Spec. No. 11: Zinc base die casting dies.



ABOVE

FIG. 1—(A) A simple part suitable for water quenching (B) The introduction of the four holes makes this part "complex", due to the thin sections adjacent to the thick sections. (C) Introduction of many equally spaced holes makes part of uniform sections and therefore "simple" from the point of view of quenching hazards.



RIGHT

FIG. 2—Good and poor tool design from the point of view of breakage hazards in heat treating and service life for all classes to tool steels.

Specification No. 12
Aluminum Base Die Casting Die Steel

Carbon	0.3	per cent
Silicon	1	" "
Chromium	5	" "
Molybdenum	1.5	" "
Tungsten	1.2	" "

This is an air hardening steel which was developed to produce those properties desired in an aluminum base die casting die. These include excellent dimensional stability, good toughness, good wear resistance, resistance to heat checking, and resistance to softening at elevated temperatures.

The base price of this material is approximately 24c. per lb.

Uses of Spec. No. 12: Aluminum base die casting dies.

Carbon ..... 0.2 per cent

As the analysis indicates, this is a low carbon steel and it must be carburized in order to develop a hard surface. Unhardened, it finds extensive use for jig and fixture parts where mass and toughness are the prime requisites rather than hardness and wear resistance. By carburizing and hardening this material the same hardness and wear resistance of water hardening tool steel are obtained with the added advantage of better toughness. Carburized machine steel is water hardening, but due to the fact that only those surfaces desired hard are carburized—leaving the rest of the tool with a low carbon content—little danger of breakage in hardening is present. However, it is subject to warpage and dimensional instability characteristic of all water hardening steels.

In specifying carburized machine steel the minimum case depth should also be specified. For most tools this should be 2/32-3/32 in. with grinding allowances after hardening of about 0.010-0.015 in. on a side.

Carburized machine steel is the best material for complex parts such as locating blocks, gage blocks and vise jaws. It combines excellent wear resistance, excellent toughness and ease of hardening with a lower material cost than any other tool steel. It is also applicable for plug gages and similar parts which are to be subsequently hard chromium plated. The current price is about 5c. per lb.

Uses of Carburized Machine Steel: Gage and locating blocks, vise jaws, clamps and mandrels.

Cemented Carbides

This class of material consists of tungsten and tantalum carbides cemented in a cobalt metal binder. It is characterized by exceptional wear resistance and cutting efficiency coupled with a high degree of brittleness. In order to overcome the latter, it is furnished in a number of grades which possess varying compromises of toughness, cutting ability and wear resistance.

Its principal use is for cutting tools and gages. The high cost, manufacturing limitations and the necessity to be backed up by a tougher material have led to its use in the form of inserts. These are silver soldered or brazed to the tool or gage shank.

When used for cutting tools, the increased efficiency of the carbides is not realized, as a rule, unless the production machines are capable of maintaining heavy and fast cuts. For gages where inserts are applicable, they outwear for most applications any other material ordinarily used for such parts.

Uses of Cemented Carbides: Lathe tools, certain inserted tooth cutters, gages of all kinds where inserts are applicable, filing jig inserts.

Hard chromium plate is characterized by high hardness and exceptional resistance to sliding wear. It also protects the base metal from corrosion. For tool work the chromium is plated directly on the metal in thicknesses ranging from 0.0002 to 0.050 in., depending upon the particular application. It is extensively used for building up worn and improperly ground parts such as cutter arbor holes and gages. Moreover, it outwears all tool steels where sliding wear resistance is the prime requisite. It is not satisfactory, as a rule, for building up cutting surface inasmuch as the plate tends to chip when used for such applications. Another advantage is the opportunity to heat treat the underlying metal to a tough temper in order to minimize breakage, and yet provide an intensely hard surface with the chromium plate.

When using this surface treatment, a minimum residual chromium thickness of 0.001 in. on a side after grinding should be specified, as well as a draw after plating of 400 deg. F. for 3 hr.

Uses of Hard Chromium Plated Surfaces: Rifling heads, gages, salvage of improperly ground and worn parts. A "flash" plate on taps, drills, broaches, etc.

Recommended Applications

In table II an attempt is made to designate specific steels for general tool and die applications. Three choices are listed, the first being that which would ordinarily give maximum service life. This list, of course, is quite subject to change for specific jobs where experience shows an advantage for another analysis. It is emphasized that the design of the tool, the maximum production desired, the type of material being processed, and other such factors must be considered in selecting the steel for each specific job. Also it is important in specifying steels for tools that the desired hardness range be included.

There are certain steels in the high speed group which almost duplicate one another in characteristics and performance, and thus may be used interchangeably. Specifically, Nos. 1 and 2 for the regular high speed steels, and Nos. 3 and 4 for the cobalt steels are equivalent.

In this table no mention is made of cemented carbides for cutting tools, inasmuch as this deals primarily with steels. However, attention is invited to the fact that carbides are well standardized in industry for use in turning tools, boring tools, milling cutters, and similar tools due to the increased efficiency for many jobs.

Identifying Steel Scrap

THE following, issued by the Ministry of Supply, England, emphasizes the importance of methods for the rapid identification of different types of steel.

A color scheme which it is hoped will assist plants to segregate essential alloy steel scrap more effectively, has been devised by the Iron and Steel Control. The plan, however, stops short of suggesting how the colors are to be applied to scrap which, as is often the case, has been broken up into small pieces or may be little more than "pairings." When a number of articles, such as small tools, some in carbon and some high speed steel, are produced in the same shop it is not easy to ensure that the scrap—whether in the form of rejected tools or broken pieces—is put into the right pile; so that the color-identification plan is not expected to prove by any means an absolute safeguard, though it is undoubtedly a sound idea.

To identify, at an early stage, scrap which has wrongly slipped through the net in as easy and rapid a way as is possible is obviously desirable and a method of rough classification which will avoid comparatively elaborate tests in the works laboratory is naturally a great boon.

In future the following colors will be used to identify the various grades:

STEEL	COLOR
Carbon	White
Nickel	Red
Nickel-chrome	Blue
Nickel-chrome-molybdenum	Green
Manganese-molybdenum	Brown
Carbon-chrome (ball bearing)	Black
Chrome-molybdenum	Orange
Stainless	Pink

Plants are urged to do everything possible to avoid mixing alloy steel scrap with carbon scrap, and alloy steel scrap should be sorted into appropriate grades. Scrap dealers should make sure they do not mix grades when collecting.

According to an official of the Iron and Steel Control, hundreds of tons of valuable alloys are being lost every week in steelworks because of poor segregation in factories and scrapyards. Accidental mixture produces faulty steels, and unless care is taken to sort this type of scrap at source it is impossible for the steelworks to make reliable new armament steels from it.

TODAY copper fights on the global fronts

Today the copper industry is working all-out to win the war. No copper is available for anything else. But post-war planners with specific problems in metals are referred directly to the Revere Executive Offices in New York.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Assembly Line . . . STANLEY H. BRAMS

• Canadian Ford adds to foundry facilities for fourth time since war... Studies on manpower find crisis still around corner... Krug reports on CMP steel allocations.

DETROIT — Across the Detroit River in Windsor, Ont., the Ford Motor Co. of Canada is increasing the size of its foundry for the fourth time since the war started, and when the job is done later this summer the installation will very likely be the largest in the Dominion. The addition for which ground has now been broken will provide 45,000 sq. ft. of floor space; steel making and casting operations will be under way during the fall.

After this $2,900,000 expansion of building and equipment is completed, output will be increased five-fold over pre-war levels, to a level of approximately 450 tons of cast steel per 24-hr. day. Equipment will include 18 large induction furnaces, 2 iron making furnaces and several smaller electric induction furnaces. Electromelt and Swindell electric furnace equipment is on order for the new installation.

The company is also expanding its heat treatment plant. This building is in direct line with the foundry and the extension to both will result in their meeting to form one continuous plant 960 ft. long by 225 ft. wide. General contract has been let to Anglin Norcross Ontario Co., Ltd., and the structural steel contract to the Canadian Bridge Co., Ltd. The latter contract calls for erection of 800 tons of steel, of which more than 85 per cent will be rolled in Canadian mills.

A 65-ft. cranebay will extend along the east side of the foundry and heat treat building, equipped with three 10-ton electric cranes and one 7½-ton crane.

The company is also proceeding with an extensive installation of permanent outside craneways. Two of these are under construction, each 784 ft. long with a span of 100 ft. They run parallel and adjacent to the foundry building and are equipped with 7½-ton cranes, each with a 54-in. electric magnet for handling metals. Foundry furnace charges are handled by one craneway, and bar and sheet metal stock by the other.

Also included in the current program are the building of a unit for storage of refractory materials, connected with the foundry by a tunnel; installation of electric annealing furnaces; a spectrograph laboratory to provide quick analysis; and other items of equipment.

The three previous wartime foundry expansions of Ford of Canada were made in 1941 and 1942 at a cost of approximately $2,350,000. Construction of buildings, installation of furnaces and the cost of all permanent equipment are financed by the company.

Considerable of the new facilities will be utilized in centrifugal casting of steel parts for universal carriers and other military vehicles.

This brings to mind that the original Ford Motor Car Co. in Detroit utilizes centrifugal casting for the production of cylinder barrels for aircraft engines, and, in fact, originally brought about air force approval of this means of production for the barrels.

Ford's centrifugal casting technique is fairly orthodox; spinning is at a rate of 750 r.p.m., however, which is considerably faster than for most applications of the process. After casting each cylinder is normalized and shot blasted to remove scale.

Metallurgical tests indicate that grain structure is importantly refined in the cast cylinders. Bursting tests find forgings splitting along fiber lines, while castings have an irregular outline. Barrels cast of S.A.E. 4140 steel have bursting strength of 9200 lb. per sq. in. against 5200 lb. per sq. in. for forged nitralloy barrels.

Ford has released some interesting figures dealing with costs on castings of cylinder heads as compared with costs on forging them. In a shop running 500 cylinders, it was said, 17,500 lb. of alloy steel a day are saved by casting. On the same production basis, forging equipment was figured to cost $134,000 while foundry equipment cost $34,700.

It can further be added in this connection that techniques and centrifugal casting are far from static. Tests are now being run in one good-sized foundry in the Detroit area in which molds are being rotated at the most unusual level of around 2000 r.p.m. Preliminary results indicate a further refinement of grain structure and a correspondingly more satisfactory product. More will be heard on this later.

A MANPOWER shortage in Detroit still appears around the corner which has always loomed a few months ahead, almost like a mirage. A year ago at this time, employers in the automotive plants were expecting dire problems by this summer. But now the worries are being anticipated for winter or early 1944.

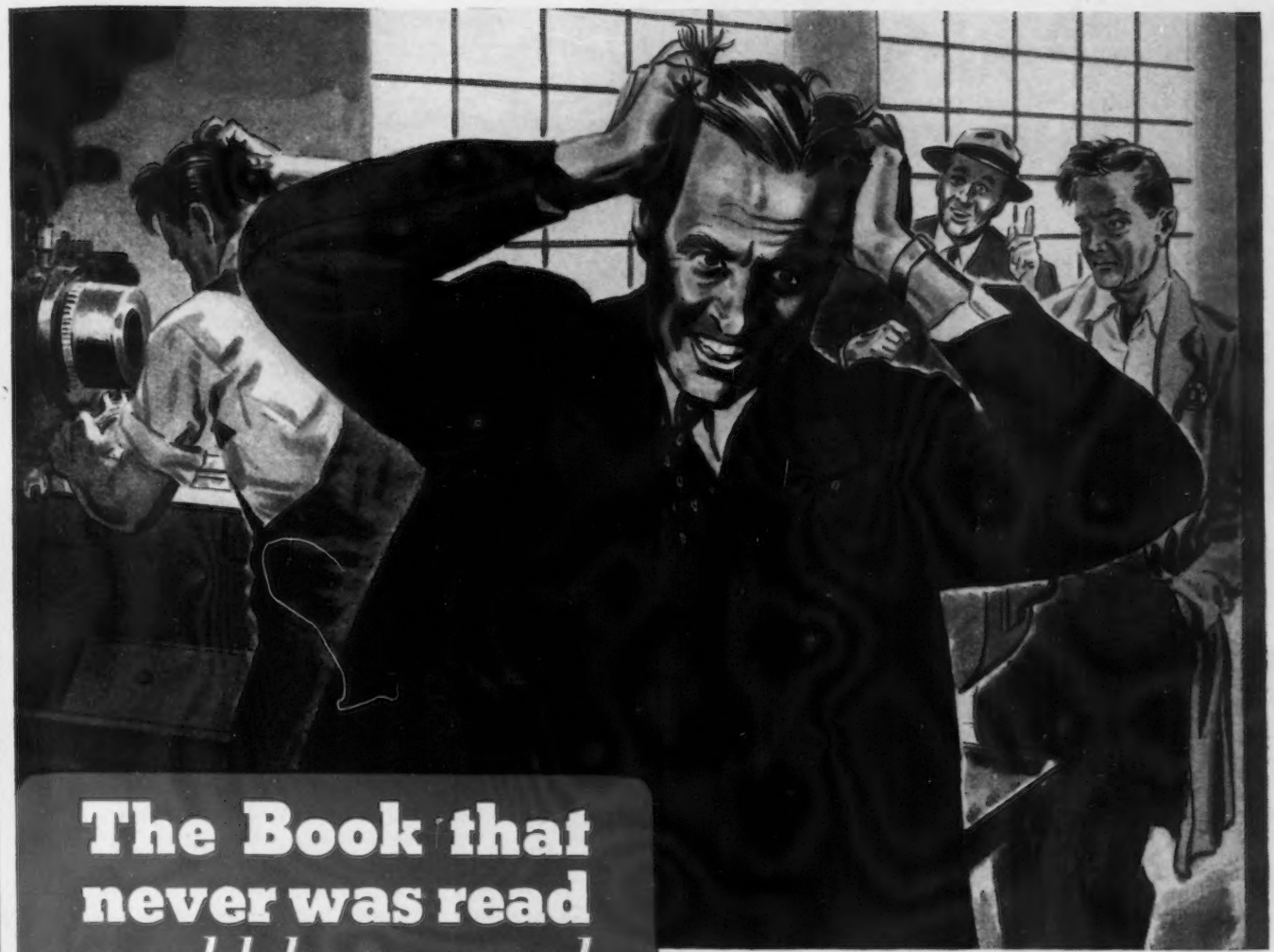
A study by the Automotive Council for War Production confirms this. The manpower utilization division has filed a report indicating that by next March there will be a "deficit" of 85,000 workers. However, in the same breath, the committee points to the increasing employment of women and the constant in-migration of workers to the Detroit area, inferring that all may still be well.

Actual employment needs are expected to expand during the 12 months from March, 1943, when the survey was undertaken, by about 133,000 workers. In addition, the induction rate of men for the armed services points to a drain of 65,000 during that period, so 198,000 additional men and women will be needed in war plants by next March.

The manpower commission estimated that other industries will furnish 25,000, that "normal" entrants will add another 20,000, that there will be 3000 unemployed available and 5000 commuters. Housewives are expected to augment the total by 60,000, bringing to 113,000 the number expected to be available by next March.

Enlargement of the number of women entering into industry is hoped for. Some companies anticipate that as much as 75 per cent of their total peak employment will be female by the end of 1943. Other companies, however, dispute this anticipation very seriously, feeling that even 40 per cent or 50 per cent may be high.

Employment of women with chil-



The Book that never was read *would have saved two days*

The superintendent was tearing his hair

A HURRY-UP DISTRESS SIGNAL brought one of Pratt & Whitney's able, versatile machine tool service men to a big war plant.

There he found a fine new Pratt & Whitney Thread Miller with its head taken apart, a repair man slowly going cuckoo, a machine operator idly standing by, and the superintendent tearing his hair over the production hold-up. "What's the trouble?" the P&W man asked.

"Rapid traverse mechanism is shot," they told him. "Spindle is frozen, the operator thinks."

"How was the machine used last?"

"Why it was running fine until we changed the set-up, and ran the table across with the hand crank. Then she went blooey." The P&W man smiled politely, growled words lost in the roar of the other machines, and set to work.

Re-assembled, the miller ran smooth as a top.

Open-mouthed, the operator and repair man stared. "What did you do?" they wanted to know.

"Nothing," the P&W man told them. "Nothing but disengaged the hand crank." And then he patiently read to them from page 12 of the instruction book that goes out with every Pratt & Whitney Thread Miller. There's an interlock between hand crank and power traverse lever. Power can't be turned on while the hand crank is engaged; we planned it that way to avoid trouble. We won't have a hand crank that will spin under power.

Moral: Machine Operators and Repairmen Should *Read* the Instruction Books . . absorb the "know-how" we have carefully written out

NOW — *it's not too late* — see to it that every machine operator and every repair man *knows* his machines. Dig up instruction books that may be gathering dust in the foreman's desk . . . or write us for additional copies. Carefully compiled, clearly stated details on your P&W machine are between those covers. The "know-how" on those printed pages can prevent the loss of production and the needless waste of our service men's priceless time. Will you help?

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PRATT & WHITNEY

MACHINE TOOLS ★ SMALL TOOLS ★ GAGES

WEST HARTFORD CONNECTICUT

Basic Accuracy for Mass Production

dren is rapidly increasing. One study of 12,000 employed women shows that 40 per cent of them were married and had children, 28 per cent were married but had no children, and the remaining 32 per cent were single. The inference is that married women with children constitute the largest available block of employment help still available and that logically, therefore, the big gains will come in this category.

Other plants in the Detroit area are finding important sources of help in part-time and handicapped employees, and older persons. Effort is being made to move the part-time employees into full-time war work classifications. Disabled veterans are being filtered into war work as they return from action theatres of the war. And older men are also being asked to remain on the job after the retirement age.

ON THEIR WAY: Valves being taken to the shipping room of the Jenkins Bros. plant at Bridgeport, Conn., where they will be earmarked for the Navy for use in fighting and cargo ships. Upwards of 80 per cent of the valve shipments are sent to the Navy.

THE Automotive Council's annual meeting last week produced little news of note except the remarks of Program Vice-Chairman J. A. Krug of the War Production Board. The Washingtonian took advantage of his appearance before the automotive producers to emphasize that any ideas they might have of being able to resume civilian goods output during the war period were born of false hopes and illusion.

Krug bolstered this contention with the story of third quarter CMP allotments of materials. Requests for carbon steel, he said, exceeded 20,000,000 tons; supply was slightly under 15,000,000 tons, necessitating over-all reduction of 25 per cent. The Army was cut 500,000 tons, the Navy 100,000 tons and the Maritime Commission, 400,000 tons. The Office of Defense Transportation, seeking 2,200,000 tons to meet expanding transit problems, was shaved to 1,200,000 tons. Copper and aluminum were cut in "approximately the same pattern, the difference being that the situation in these metals is even tighter."

Krug reported that 70 per cent of the carbon steel allocated for the third quarter was for direct military use—Army, Navy, Maritime Commission, Board of Economic Warfare, Lend-Lease, and Canada. An additional 18 per cent went for farm equipment, railroads, utilities, new building construction, oil wells, aviation gasoline plants and synthetic rubber plants. More than 5 per cent went to warehousing and maintenance, repair and operating supplies.

Mentioning these allocations, Krug reported that "we are running uncomfortably close to the danger line" in our allotments for the petroleum industry, for utilities, for railroads, and for other essential services upon which both war production and the civilian economy rest. The Petroleum Administration, for example, was said to have been alloted only around 300,000 tons of carbon steel for its overall program, including aviation gasoline, new pipelines and drilling of wells.

KRUG dwelt only lightly on CMP and its problems. It must be said that some of the earlier long-faced worries of Detroit on this score are appearing to alleviate. Second quarter shutdowns, so freely anticipated in April, have not come to pass, although only good inventory positions saved the day for many firms. The big worry now is inability to keep up with the day-by-day changes in the plan; the growing problem is maintaining balanced inventories. Aluminum, for instance, is said to be tighter than for many months, particularly in forgings and extrusions, while copper is easily had and perhaps even piling up a bit.

Inventory-building calls to mind one other worthy thought handed out at the Automotive Council meetings. This came from Courtney Johnson of Studebaker, who has all but moved from South Bend to Washington as the industry's liaison man on materials. Johnson bespoke the danger of winding up the war with high inventories which would for a time at least represent frozen assets whose cash equivalent might be sorely needed in the reconversion period. Johnson did not say so, but likely he was thinking, too, what effect the CMP limitations might have on the translation of these inventories into cash at contract termination time. Corporations hereabouts believe that the 60-day inventory limit of CMP will be a measuring stick in contract termination discussions at the end of the war. If a company has a 90-day supply, this thinking goes, it will be ruled out of bounds with 30-day excess, and will have to absorb a loss on it.

Army Negotiating for Engine Plant in Toledo

Toledo

• • • **The War Department** is reported negotiating with the Defense Plant Corp. to take over the plant erected here for the Liquid-Cooled Engine Division of Aviation Corp.

It is said that the War Department plans to enter into a contract with Packard Motor Co., Detroit, to operate the plant. Packard is producing Rolls-Royce airplane motors.

Negotiations involve transfer of the plant and its facilities from the control of the Navy to the Army.

The plant cost the government more than $5,000,000, and is one of the largest in Toledo.

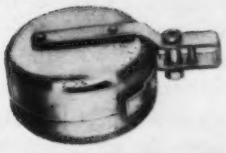
Let Carpenter help you produce MORE STAINLESS PARTS—*faster*

Helping you speed output of perfect Stainless Steel parts, and cut rejects to a bare minimum, is part of Carpenter's wartime job. The groundwork for this job was laid many years ago when Carpenter invented Free-Machining bars and developed ductile Stainless Strip. Today, Carpenter Stainless Steel is licking more and more tough fabricating problems. And daily we are adding to the wealth of practical experience we have gained in working with Stainless users.

Take advantage of Carpenter's diversified knowledge of Stainless Steels. Your nearby Carpenter representative can help you *in the shop*—and can provide you with assistance from our Metallurgical Department.

Faster machining

of this gear is made possible with Free-Machining Carpenter Stainless. At the same time, Carpenter Stainless Steel keeps wear and corrosion of such parts to a minimum, prolonging service life.



Easier fabricating

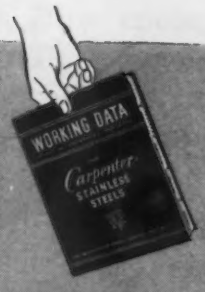
Carpenter Stainless Strip helps speed output of this aircraft carburetor part. Then too, the ductility of this Stainless Strip makes possible smooth forming and deep drawing.

Fewer rejects

in making these all-Stainless steam trap parts result from the constant uniformity check of Carpenter Stainless Strip at each step of manufacture. And this Stainless protects products from the most severe temperature conditions.

Close tolerances

on the two metal screens of this pigeon liver slicer are met easily when Carpenter Stainless is used. And in service, this Stainless combats corrosion from blood and constant sterilizing.



Here's fabricating data

for your production men. They can use this information to help iron out fabricating difficulties all along the line. These are some of the subjects covered in the Fabricating Section of our 98-page book, "Working Data for Carpenter Stainless Steels":

- Machining
- Forming
- Stamping
- Bending
- Forging
- Annealing
- Welding
- Grinding

And here's helpful design-engineering data

about Carpenter Stainless Steels. "Working Data for Carpenter Stainless Steels" covers these and other subjects:

- Physical Properties
- Corrosion Resistance
- Electrical and Magnetic Properties
- Workability
- Heat Resistance

A copy of "Working Data for Carpenter Stainless Steels" is waiting for you. Drop us a line on your company letterhead and we will get it off as soon as possible. This Working Data book is offered to users of Stainless Steel in the U. S. A.

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121 Bern St., Reading, Pa.

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Washington . . .

L. W. MOFFETT

• Belief is growing that OPA needs to be streamlined to accomplish the tremendous work that lies before it . . . Talk of "incentive wages" to help step up steel production in third quarter is heard.

WASHINGTON—An organization such as OPA, huge, sprawling, shot through with widely divergent political and economic ambitions, could not possibly expect to escape criticism. And that is what it is getting in abundance. Right now the main attack comes from Congress. No doubt some of the criticism from that source is politically inspired. On the other hand, a great deal of it makes sense and is constructive. Housewives, ruffled over rationing, scarcities and soaring prices of food, clothing and household furnishings, are becoming more caustic in their comment both publicly and in the precincts of their homes.

The general line they take is that much of the scarcity with resulting price increases is unnecessary. Poor management and distribution are blamed. Accustomed to a free economy and abundance of supplies, they have not become reconciled to a new system of depleted supplies, higher prices, lower standard of living and regimented marketing. Perfectly willing to make sacrifices if convinced that they are justified, these housewives have husbands, sons and brothers in the armed services and it is not at all necessary for Washington to pour out volumes of pompous lectures by the radio, press or platform to make them "war conscious." These self-sufficient lecturers to the contrary, the housewives, regardless of geographical sections, are completely aware that this country is faced with its toughest struggle and that it will mean a lot of sweat, blood and tears before it is over.

There should be a let up of worry over "war consciousness" and of talking down to housewives. Substituted should be sensible talk based on honest thinking to explain more clearly the reasons for rationing, scarcities and higher prices, each of which will become worse before becoming better. In terms that are simple, factual statements and comparisons should be set forth to point out the endless demands for food, clothing, transportation and munitions that are made by a global war upon a nation that seeks to set itself up as an arsenal of democracy and also to a large degree an almoner of food and clothing supplies. There may still be a conviction that the policy of distributing our products so widely and freely is overgenerous, but at least the cause of unusual inconveniences and high prices would be more clear and OPA might be given less criticism.

Industry too is critical of OPA. But on one score industry is not complaining as much as it had been previously. This relates to the interminable flow of questionnaires, many of them silly, and useless and all of them time-consuming for industry that is being pushed quite properly to top war production. The squawks from industry and from Congress have brought down the output of the quiz literature that for the most part was authored by "economists" who too often had their eye on straight-jacketing industry rather than gathering current information from it for its bearing on the war effort.

THOUGH he has been criticized as being too-easy going and not fully alive to the tremendous job that was placed in his hands, Administrator Prentiss Brown has been credited with having much to do with the slash in the questionnaire production. Mr. Brown also had entered upon his task with the sensible view that OPA had become impossibly unwieldy, that it should be sharply reduced in personnel, including a heavy cut in its ponderous legal staff of 2700 lawyers. His idea was to give up the unattainable task of controlling millions of prices that are as uncontrollable as the weather.

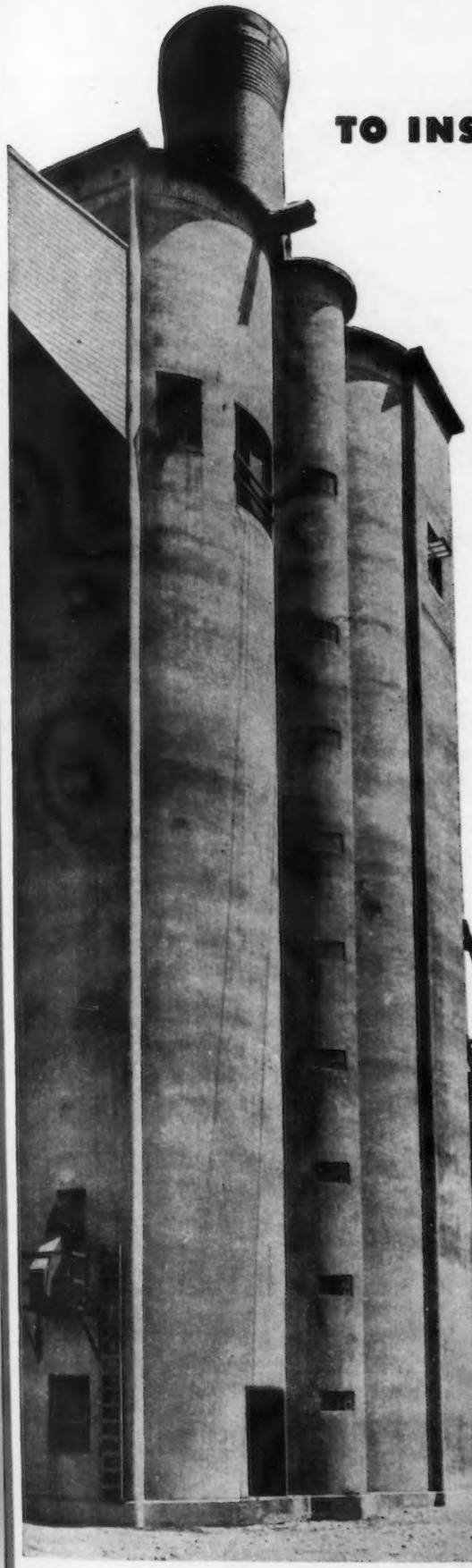
Mr. Brown did abandon pricing of some non-essential and luxury items, whose production and purchase had no possible bearing on the economy of the nation or any inflationary influence. He did not go beyond this point. Whether he was stopped or not is not clear. He had a broader policy in mind. For when he took over Leon Henderson's job, Mr. Brown said that his job was to "fix prices, not profits." His intention, he announced, was to reduce price ceilings in cases where unit costs of producing goods has declined because of expanding production. He indicated that price control would be considerably restricted and that profits would be controlled more largely by taxes and renegotiation of contracts. But Mr. Brown has pretty well followed OPA's original pattern of attempting to control all prices, no matter how unimportant some of them are, an effort that has not been and will not be achieved.

THE view prevails that not only the growing criticism of OPA but its many failures that are inherent in its set-up—its inability to control the overall price economy—will threaten its existence.

It would be absurd and highly dangerous to do away with price control in time of war. Chaos with uncontrollable inflation would be inevitable and as disastrous as war itself. But there is a growing feeling that OPA badly needs to be streamlined. The opinion is widespread that it should be simplified, greatly shaken down in personnel and devoted to control of prices in basic products—machinery, steel, lumber, food, clothing. Price

Renegotiation Hit As Incentive Loser

• • • Defining renegotiation as "a $2 name for a very old and much used policy, formerly known as piecework wage cutting," J. F. Lincoln, of the Lincoln Electric Co., Cleveland, stated before the House Naval Affairs Investigating Committee in Washington June 18 that "if renegotiation does not recapture nine times the amount of money sacrificed by loss of incentive, it must of necessity lose money for the taxpayer."



TO INSURE PLENTY OF Magnefer

...to meet the steel industry's wartime needs

OUR FACILITIES for manufacturing clinkered dolomite are now supplemented by a new D.P.C. Kiln Plant, recently completed at our Maple Grove property and now in full production.

Built under war restrictions, using a minimum of critical materials, it is none-the-less of advanced design, incorporating all the company's "know how" and experience gained in 26 years of manufacturing clinkered dolomite refractories. It has already demonstrated its efficiency, close control of quality and dependability of operation.

In addition to Magnefer for open hearth maintenance, this new plant is producing Syndolag, a rice-sized dolomite clinker ideal for maintaining electric furnace banks.

Better balanced production at Maple Grove...attributable to both this new D.P.C. plant and other additions and improvements made in anticipation of war conditions... means adequate service on all our refractory products for hearth construction, repair and maintenance.

BASIC REFRACTORIES, INCORPORATED

845 HANNA BUILDING • CLEVELAND, OHIO

PRODUCERS OF MAGNESITE AND DOLOMITE HEARTH MATERIALS FOR STEEL FURNACES

control over the basic lines, it is contended, would automatically control prices of related lines that are essential. As for other lines, lack of control would not matter. The simplified control would be more effective than is the present arrangement which in many respects has become chaotic.

OPA has done a pretty good job of price control in such basic industries as steel and machinery. By confining this policy to the basic industries under the direction of a streamlined, mobile organization, with a slashed personnel, it would contribute much to the war effort.

Such an organization would have a flexibility not now present to meet changing conditions more quickly and to adjust price control accordingly. This is a problem that is moving swiftly to the forefront and will have to be met. It is present in steel. It concerns rising costs and immediately brings up the big job of "holding the line" against inflation, if it can be done. Steel has been put on a uniform 48-hr. by fiat of the War Manpower Commission. This means higher wage costs. Then, too, there is talk of "incentive wages" to carry out the White House order to step up steel production by 1,000,000 tons in the third quarter. There is a "break point" where the industry will have to get higher prices and these two developments might well be that point. It is going to require a well-organized, fast moving OPA, stripped of surplus fat that is now slowing it down, to do the tremendous work that lies before it.

The first World War price control operated largely on this basis. While this is 1943 and not 1917-18, there certainly has not been any such a vast dimensional growth in war activities as to justify the bureaucratic monstrosity that has been set up to run the war on the home front.

Inventory Ruling Tightened on Steel

Washington

• • • **A step toward increasing** steel supply in the third quarter in response to the OWM "must" order, WPB last Saturday put into effect a regulation interpretation tightening up on inventories. Under this interpretation, made to CMP Regulation 2, material is to be considered inventory until it is actually put into process or assembled. The regulation prohibits the acceptance of delivery of any item of controlled material if the user's inventory is, or by virtue of such acceptance will become, greater than the maximum prescribed.

Thus the interpretation points out, putting into process does not include minor initial operations, such as painting, and does not include any shearing, cutting, trimming or other operations unless such initial actions are part of a continuous fabrication or assembling operation. Nor does it include inspection, testing and aging, not segregation or earmarking for a specific job or operation.

For example, it was explained, if a manufacturer who uses wire or rod cuts cuts a sufficient quantity of it to length at once to maintain his operations for a considerable time, the cut pieces remain as inventory until processed into another form or until assembled or installed.

Also, if a manufacturer purchases and stores steel castings in the form purchased, and the steel castings are not put into process, the inventory includes those painted and stored. Likewise, if a manufacturer shears steel and stocks it in sheared form, such stock is still a part of his inventory if the material does not continue into production.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

Producers Must Notify On Delayed Steel Shipments

Washington

• • • **WPB Steel Division** Director H. G. Batcheller in a recent letter notified steelmakers that any producer who has accepted orders that he does not expect to ship in the month requested must immediately notify his customer and take steps to correct the status of such orders.

David Austin Resigns From WPB Steel Division

Washington

• • • **David F. Austin** has resigned as assistant director for production in the WPB Steel Division, having been recalled to Pittsburgh to resume his duties as vice-president in charge of sales of the Carnegie-Illinois Steel Corp. Mr. Austin served as executive consultant to both Carl Adams and Reese H. Taylor, former Steel Branch directors. Shortly after H. G. Batcheller, WPB Steel Division Director, took over the office, he appointed Mr. Austin chief of the Production Branch, the largest branch in the Steel Division, which has charge of about 72 products. Mr. Austin is credited with organizing the branch into its present state of efficiency.

He's Alive—

DUE TO FAULTY JAP INSPECTION

OFFICIAL PHOTOGRAPH, U. S. ARMY AIR FORCES

Sergeant holds a 20-mm. Jap shell which hit his Boeing B-17 but failed to explode during a battle with ten Zeroes.

Had the Jap inspectors who passed this 20-millimeter shell done their full duty, this U. S. plane and the flyer holding the shell might have crashed. Although this shell penetrated his ship at a vital point, it failed to explode. Good American shells brought the Jap down.

Thorough inspection of every shell with reliable gaging equipment is the only way to prevent the double tragedy of faulty ammunition. American gunners have the right to demand that every round they fire will accomplish its full share of destruction when a hit is scored.

SHEFFIELD
MASTER GAGEMAKERS

THE SHEFFIELD CORPORATION

Dayton, Ohio, U.S.A.

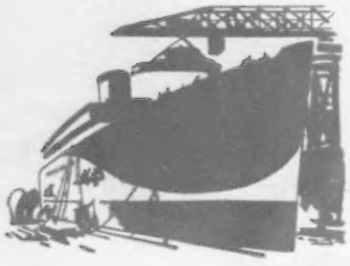
AUTHORITIES IN DIMENSIONAL CONTROL

The Sheffield Multichek is a precision instrument which checks all critical dimensions of shells, fuses, and other parts in a single quick operation and without being influenced by human error. Write for folder No. 43-1.

WEST COAST . . .

OSGOOD MURDOCK

• Quarter million more workers will be needed for full production operations by May . . . Fontana ordered to convert all pig to billets . . . No cast iron scrap available.



SAN FRANCISCO — As the Dies Committee tried to switch its danger signals from red to yellow by holding hearings on the Japanese internee problem without benefit of counsel of WRA, and as playful representatives of the armed forces undertook a private and personal "zoot suit war" during their recreational hours among the wolf holes of Los Angeles' environs, the awful truth of worse labor shortages to come clouded over the so-called "Bay Area" and, like the summer fog from the Pacific, drifted through the Golden Gate and settled rather generally over the supposedly golden landscape of California.

Before a sub-committee of the House Merchant Marine Committee, presided over perhaps not entirely disinterestedly by Congressman J. L. O'Leary, New York Democrat, it was the testimony of George S. Roche, labor market analyst of the War Manpower Commission regional office, that 105,000 additional workers must be added to essential industry "in the Bay Area" by next May, of which 67,000 would be shipyard workers. This large number is, of course, in addition to the replacements necessary to offset a present labor turnover of 14.5 per cent in shipbuilding which General Manager Clay Bedford of the Richmond yards believed might be reduced to 8 or 10 per cent if additional housing facilities are provided.

If the same ratio holds for all California, a total of 175,000 additional workers will be required to man completed additional facilities and full throttle potential operation in California alone. For the entire Pacific Coast the number may very easily be estimated at 250,000. Public officials and private management have struggled valiantly with overcrowded housing and transportation, with arid-thin supplies of food and service labor. They are now discouraged and incoherent as they face the prospect.

Congressman O'Leary, on the other hand, had ideas. "There's been a mistake somewhere—you've got too much shipbuilding on the West Coast," he declared. "Someone has failed miserably in figuring this problem," chimed in Congressman Louis J. Capozzoli, another Atlantic Coast Democrat on the five man sub-committee. "Why should New York with 13 million population and 500,000 unemployed be without a shipyard? Shouldn't we have a shipyard?"

On the basis of the testimony, no one could directly dispute the inference.

MINIMUM wages by the year of $2600, by the week of $50, and by the hour of $1.08 were stipulated by the California CIO Council's Research Department before a regional War Labor Board hearing on sub-standard wages and minimums as "the least we can recommend for a standard wage" during the war emergency, to "maintain the worker as an efficient producer of goods, keep his family in health and decency, and enable him to carry his proper share of the financial burden of the war."

According to the AFL Teamsters, a minimum of $1 an hour or approximately $2425 a year could be considered a cost of living workers' "floor." The Building Service Employees Union dropped their floor even lower in suggesting a standard of $1800 a year.

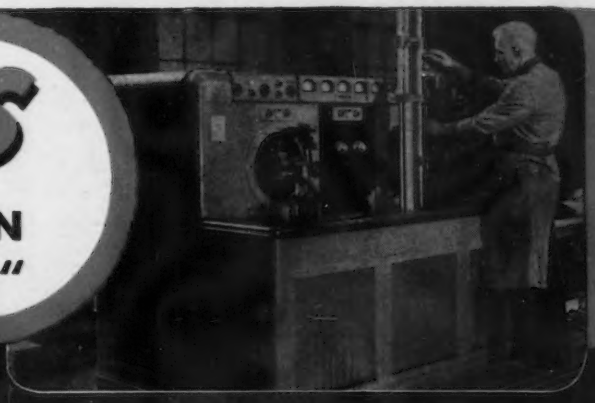
ORE CARRIERS: The network of ore conveyor belts at the steel mill of the Kaiser Co., Fontana, Cal., is driven by more than 35 Westinghouse 5 to 75 hp. gearmotors. Full ore load of the belt shown is 450 tons per hr. at a speed of 265 ft. per min.

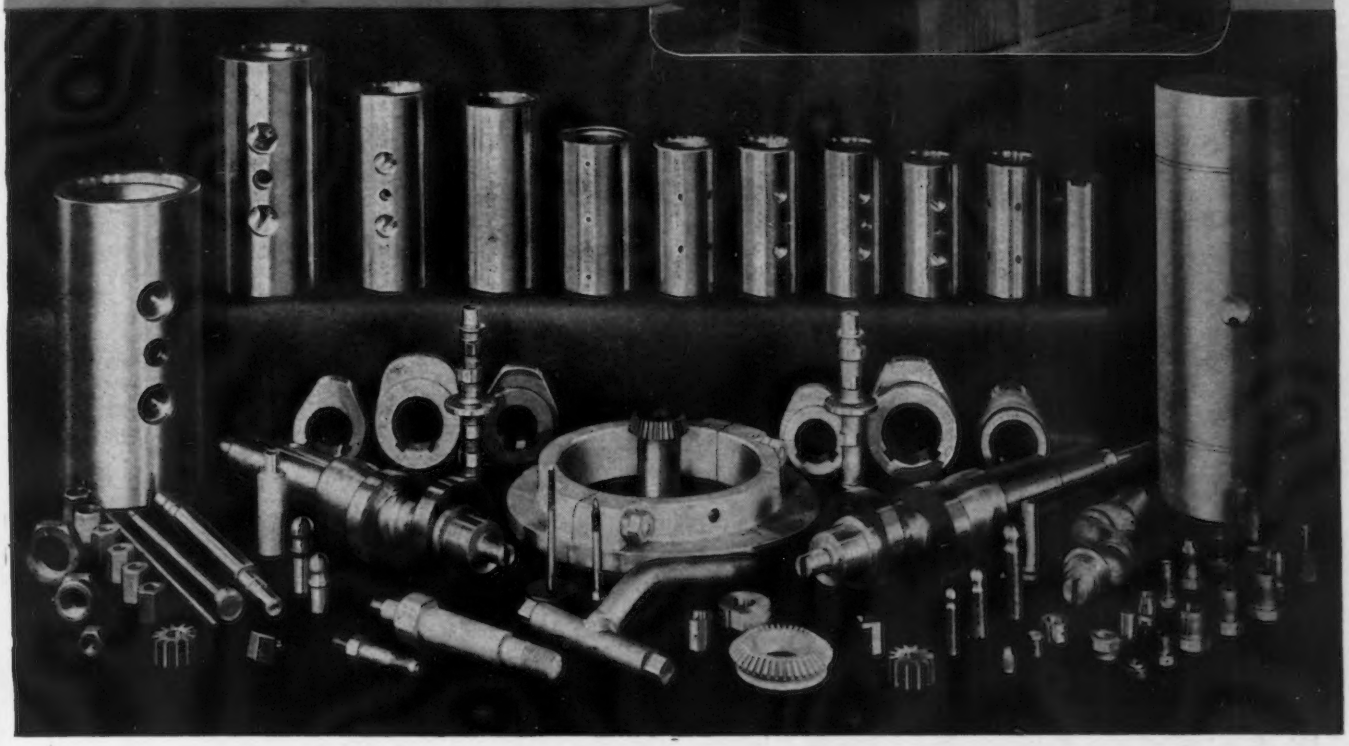
BEFORE the American Society of Mechanical Engineers in annual meeting at Los Angeles Edward A. Howard, aeronautical engineer and special assistant to the president of Lights, Inc., at Alhambra, outlined in detail the elaborate management of sub-contracting worked out by that organization. Industrial engineering principles have been applied to sub-contracting and in the past eleven years the organization has engineered business management and production problems without apparent investment in plant facility. A research department with extensive aeronautical, electrical and chemical laboratories develops and tests promising proposals and proposed products. Approved for production, the executive department includes administration, public and industrial relations, legal and finances, works management, planning, estimating, purchasing, production and quality control. Materials are purchased and the entire production program is worked out, depending entirely upon outside sub-contracted facilities. The production department controls the assembly of the finished parts but its small shop is used only to work rejects over and complete last minute operations.

That sub-contracting is a flesh, bone and sinew part of the aircraft industry was further evident when Boeing at Seattle leased a building at Aberdeen, a lumber mill center on Grays Harbor, 100 miles from Seattle. On 36,000 sq. ft. of floor area, 750 workers will be employed on a sub-assembly which will be shipped complete to the great Seattle Boeing plants. Other decentralized operations will be scattered through the Pacific Northwest where labor, housing and comparatively simple sub-assembly

79 PARTS

HARDENED BY THIS "ONE MAN HEAT-TREATING DEPARTMENT"





THE COOPER-BESSEMER CORP., renowned builder of top-quality engines and compressors for vital war and peacetime equipment, is discovering how to reap the benefits of TOCCO Induction Hardening to the fullest extent. Its progressive engineers have scheduled 158 different parts for this versatile "one-man heat-treating department"; are already TOCCO-hardening 79 parts, 75 of which are pictured above. Highlights of these operations:

Sizes of parts vary from ½ oz. set screws to 186-lb. cross-head pins.

Materials include SAE 52100, SAE 4615, SAE 1112, SAE 1045, NE 8620 and Meehanite Metals.

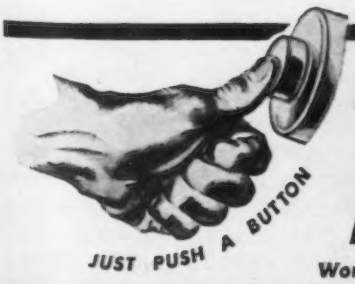
Typical time savings: Formerly hardened 100 large wrist pins in 13.5 hrs.; now they TOCCO-harden 100 in 3.5 hrs.—saving 10 hrs. per 100 pins. Push-rod buttons formerly required 3 minutes, now 15 seconds. They're now TOCCO-hardening cams, valves and other parts in ¼ to ⅓ former time.

Typical production: In 12 man-hours, TOCCO hardens 1800 pieces—12 different parts—12 different set-ups.

Other benefits: TOCCO's localized hardening eliminates straightening, reduces grinding or machining. The compact, clean TOCCO machine affords favorable working conditions.

Our experienced engineers will show you ways in which TOCCO can improve *your* production.

THE OHIO CRANKSHAFT COMPANY
Cleveland, Ohio



TOCCO

World's Fastest, Most Accurate Heat-Treating Process

HARDENING
ANNEALING
BRAZING
HEATING for
forming and forging

facilities are available. This extends and adopts the plan already in operation by Consolidated-Vultee out of its San Diego plant, decentralizing production and taking advantage of more remote facilities.

SHORT for the past year or two, the supply of cast iron scrap available for West Coast foundries has dwindled to a trickle. There is every probability that it will be long, if ever, before the former plentiful days of $15 a ton scrap return. For a while purchasing agents for larger foundries could locate remote spots in Montana or New Mexico, Idaho or Wyoming. But even for freight up to five and six dollars a ton additional, these sources have dwindled. By the time the buyer pays $22 a net ton for cast scrap, he can do about as well with $27 a ton pig and many believe that this will be the major foundry raw material henceforth.

Unfortunately for West Coast foundries, grey iron ceiling prices assumed cast scrap at not over $20 a ton which is simply not now physically available in the Pacific area.

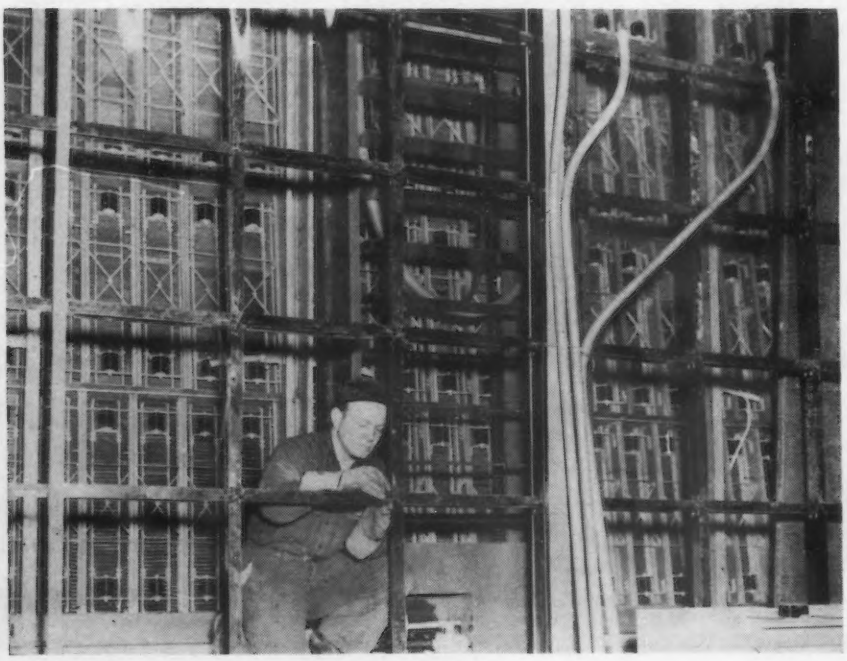
To add to current perplexities, Kaiser at Fontana has been ordered to convert all reserve pig and all the 1000 tons a day now being produced into steel billets for stockpile for the day four or five months hence when the plate rolling mills will be in operation. Therefore, until Columbia's Ironton No. 2 at Provo is in operation for the Defense Plants Corp., there may be only scarce quantities of pig on the West Coast.

CARL BUCKENROTH, welding superintendent for Associated Shipbuilders on Harbor Island at Seattle, got the idea from the tooth paste tube and aluminum piston ring plan. Three welding rod depots have been established in the yard. At the start of a shift each welder checks out a full box of rods. When he or she needs more rods, one new rod is issued for each stub returned. If the stub is too long, it is refused and must be put back on the fire. All stubs are sold as first class scrap. Using 150,000 lb. of welding rod per month, there is a saving of 24,600 lb. of rods worth approximately $2000 in cold cash. Reducing the length of stubs from three and a half to one and a half inches saves 166 lb. per thousand.

INCREASED production and planning efficiency are steadily reducing the percentage of scrap available from shipyards, particularly from the Maritime Commission Liberty shipyards on the West Coast. In the lush early days, the percentage of scrap to total material and plates ran as high as 20 per cent. More precise and careful planning and utilization of material has reduced the scrap percentage below 10 per cent and it is felt that ultimately a ratio as low as 5 or 6 per cent may be achieved, at least by the single model Liberty and Victory shipyards.

Although present reserves at the comparatively small West Coast mills are comfortable, it seems now probable that there may be a shortage in the fall. Efforts to force collection of scrap have relaxed and processors are still handicapped by labor shortage, marginal ceiling prices and oppressive OPA restrictions and regulations as to classifications, standards and niceties of preparation.

CLEAN AIR FOR STEEL MILL: Electrically cleaned air is passed through the turbo-blower that provides air for a blast furnace at the Kaiser Co. steel mill, Fontana, Cal., by a bank of Westinghouse Precipitron cells which make up the electric air cleaning device shown in the picture.



Fog Increases Threat to Ore Carriers' 1943 Goal

Buffalo

• • • **Only an extended** navigation season, with boats moving downlake well into December, will enable ore carriers to reach this year's goal of 91,000,000 tons, is the opinion of Shore Capt. John A. Montgomery of the Boland & Cornelius fleet.

While the ore fleet is larger than a year ago, shipments are considerably behind 1942's record haul. Most recent drawback has been the persistence of fog in the upper lakes, where two boats have been sunk and ten others damaged in collisions in the last two weeks. Sinking of the George M. Humphreys plus time required to repair the D. M. Clemson, removes about a million tons from the fleet's capacity.

Capt. James Herbert, skipper of the self-unloader Diamond Alkali, reported that the fog has been the thickest he has experienced in 35 years as a lake sailor. Several ore-laden boats were forced to anchor above the Soo awaiting clearing weather.

Hot Top Cap Makers Strike; Effect on Steel Probably Small

Cleveland

• • • **A strike of about 3800** workers in some 25 clay tile and brick plants in Ohio, Pennsylvania, and Indiana, shutting off a supply of refractories for hot topped ingots is not expected to have any major effects on steel production. Some mills, instead of using the fire clay caps in hot topped, have been using cast iron forms with fire brick facing. Other mills that do not use this type of hot top report substantial inventories of materials so that unless the strike is prolonged, no effect will be had on steel production.

Fatigue Cracks . . .

BY A. H. DIX

He Likes It Hot

• • • We were in Washington the week before last on a junket with some other members of the Fourth Estate, and are glad to pass along to you what we learned. This is, of course, as everyone says in Washington, even when announcing it's a nice day, strictly off the record.

First we learned that the President does not like air conditioning. The ante-room to his office is cooled, but his own office is not. So we sweltered while he delivered a short homily on inflation, which would not have strained the brains of the brighter members of Miss Klotz's sixth grade class.

At press conferences you stand up in front of the President's desk, and naturally there is much jockeying for front row positions. Everyone would get a good view if the little fellows were let in first, the medium sizes second, and the tall ones last. But the tall ones, who are usually the heaviest and who therefore can push hardest, usually get ringside standing room, while those of lesser displacement gravitate toward the back rows, where all they can do is listen.

By standing on our tiptoes we were able to see down as far as the President's Adam's apple. He looked happy and healthy, and seemed to be less weighted down by his burdens than is the assistant traffic manager of the Butzdorf Bolt Co. over his troubles in getting trucks to unload a carload of rod that is eating its head off in demurrage charges.

He, the President, expressed great satisfaction over the way women are solving the man power problem, and implied that these are great days for the razor blade people, owing to the fact that the influx of women into factories is causing the men to look their prettiest.

We always wondered whether his name was pronounced *roze-velt*, *roze-a-velt*, *rooz-velt*, *rooz-a-velt*, *rohs-felt*, or *rohs-a-felt*. He pronounces it *roze-velt* — two syllables, accent on the first.

The giant globe in back of his desk was turned toward the Pacific, which probably means nothing at all. He usually answers questions, and we were sorry he didn't have time to the day we called, as we were going to ask him, off the record, to settle a bet as to where the landing in Europe will be made.

Second Hearing

• • • Donald Nelson, Gardner Cowles, two of the Davises — Elmer and Chester — and others talked to us but told us little not already detected and reported to you by your Capital radar, Leon Wesley Moffett, in his weekly Washington section. The best talk we heard was by Leon Henderson, who seems to be endowed with an uncommon amount of commonsense and who has the happy knack of giving his listeners the impression that he believes they are equally blessed.

Incidentally, Henderson fears that in the battle against inflation the enemy's superiority of fire power is increasing.

New Etymological Pet

• • • A new word, or rather a new use for an old word, spreads through Washington like measles through the third grade. The word of the hour is *area* — "In this area of prices" — "the unskilled labor area" — the upper areas of corporate profits."

To show that you are in the know you should use *area* at least once every two minutes, but never in its dictionary geographical sense, as that would stamp you as an outlander. Of course, the latest styles in words are not long confined to Washington. They pass to the hinterlands in such items as this one on page 115 of your favorite family journal's June 10 issue:

> " . . . it is expected that the new procedures will be extended rapidly to all areas of components manufacture where . . .

A Little Lemon, Please

• • • The most entertaining speaker we heard was a British naval officer, Admiral Sir Percy Noble, who strengthened our conviction that either the English are singularly fortunate in their selection of spokesmen or else the British climate is conducive to the acquisition of a superior platform patina.

They are masters of understatement and deprecatoriness, and avoid statements that would chafe even the thinnest American skin. They praise, but take infinite pains to see that not the slightest suggestion of criticism creeps into their remarks. This extreme politeness indicates a lack of the whole-hearted spirit of cooperation that should exist between allies.

We long for the day when an Englishman may feel safe to begin his remarks, "To be frank, gentlemen, while we like the way you are handling . . . , we think you are making a miserable mess of . . . ."

Paper Waster

• • • We are great believers in the curative properties of honest criticism, especially when we are administering it, as we will now proceed to do to Elmer Davis, who heads the Office of War Information:

> Dear Mr. Davis:
>
> As you know, there is a shortage of paper. This journal, like others, has trimmed its margins and lightened its stock, to keep within the WPB's 90-per-cent-of-last year's-consumption ruling. But look what your bureau has done It has just issued a 64-page book entitled "American Air Transport," which is printed on only one side of each sheet. Actually, only 30 of the 64 pages contain any printing. Shame!

Plug

> . . . The latest issue of Iron Age which follows the machine tool industry closely and has somewhat better connections than this correspondent among the dollar-a-yearmen says that the entire Lend Lease appropriation for machinery and industrial equipment during the coming 12 months is only $504,000,000.
>
> —*PM*

We asked "Moff," your Washington listening post, who is "like that" with the dollar-a-yearers, if he plied one of them with beefsteak and beer and then applied the needle. He said no he got the figures from the Congressional Record.

Ersatz Beefsteak

• • • Which reminds us to mention that if you run out of red ration coupons or if your butcher runs out of meat a good substitute is "Widerstandschmelzschweissung." Pronouncing it six times with a mouth full of potatoes is the equivalent of a half pound of beefsteak.

We picked up the word in the recent article, "*Flange Welding on Light Metal Sheets,*" which is a translation of "*Schweissen duenner Leichtmettalbleche durch Widerstandschmelzschweissung.*"

Heap O' Coal

Page 103 of last week's issue reads:

> Harold L. Ickes orders Republic Steel Corp. to operate its Alabama mines at full capacity on a six-day week until at least 60 days supply of coal is in storage.

The next item on the same page reads:

> Charles E. Kohlheep has been appointed director of the WPB Production Bureau. . . .

Puzzles

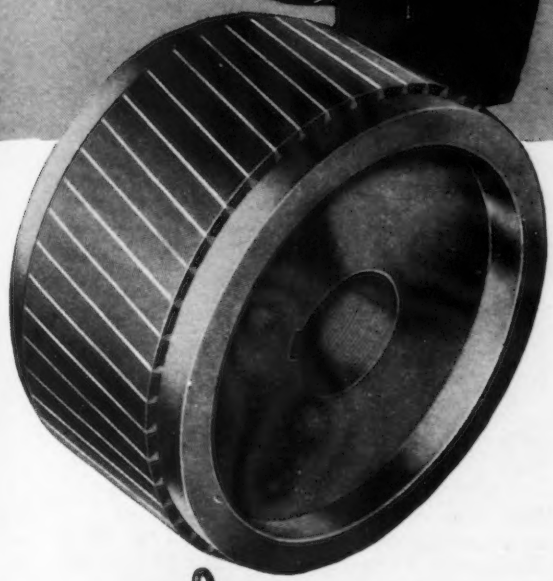
• • • Last week's king's crown contained 30½, 9½, 14½, and 5½ oz. of gold, brass, tin and iron, respectively.

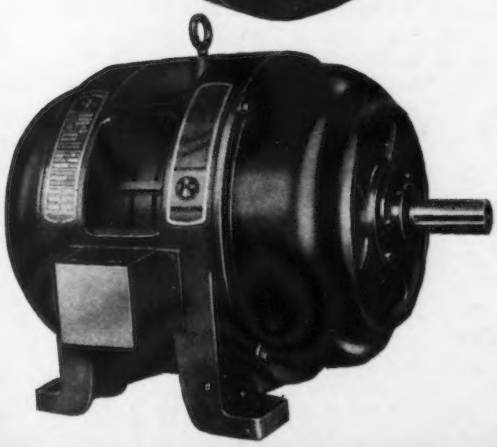
Rodney Dean and Miss Gertrude R. Taylor complain that you can't pack a gun 1.73 yd. long in a flat case 1 yd. square, as the diagonal is only 1.41 yd. However, you can pack it in a cubical case, 1 yd. each way, as the diagonal is 1.73. Our puzzle book failed us.

The June 10 problem was just a trifle to Lane Ladd, E. N. Yeager, George Benoit, and others. But not this:

Find a number which with its square contains each digit (except zero) just once.

When You Can't Buy 'em *BIG*—Buy 'em *GOOD!*





REALLY, it's no hardship when you have to buy smaller motors. *You save money.* But remember, when you can't buy 'em big—buy 'em good.

Now that you cannot depend on oversize to take your motors through tough service—you must depend on quality.

That is why you should investigate Fairbanks-Morse Motors with *Copperspun* Rotors.

The winding of the *Copperspun* Rotor is centrifugally cast of COPPER in one piece. It provides electrical and thermal characteristics that give this motor the stamina to stand up under the most severe service without mechanical failure. You can operate a Fairbanks-Morse Motor with *Copperspun* Rotor at its full rated capacity continuously and indefinitely without fear of damage from overloading.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Copperspun

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
ELECTRICAL MACHINERY
SCALES
MOTORS

WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

Motors

Dear Editor:

BROKEN GRINDING WHEELS

Sir:

In the May 27 "Dear Editor" page, Dorothy Dase, after describing frequent breakage of grinding wheels and her futile attempts to design stronger wheels and better guards, asks, "Can anyone suggest anything?"

We suggest that an investigation be made to find out what is causing the breakages. Once the cause has been located, it should be relatively easy to correct. We agree with Miss Dase that it is dangerous to work on a grinding machine where wheel breakages are frequent occurrences, but we want to point out that a situation of this kind should not be necessary. Grinding wheels are not dangerous tools when properly used. They don't just break by themselves. When breakages occur there is something wrong somewhere and this must be ferreted out.

Possibly the speed is too high, or the wheel too large for the machine. Maybe the wheels are not of the right grade or the best shape for the job. There may be something wrong with the mounting or method of applying the wheel to the work. Anyone of these things could be the cause of the trouble.

The manufacturer who is supplying the wheels will undoubtedly be glad to lend every possible assistance in making the investigation. He is just as much interested as the user in eliminating breakages. Because of his wide experience and knowledge of grinding wheels, the abrasive engineer is frequently in a better position than the user to locate the trouble. Why not give him a chance to help?

A. ROUSSEAU,
Product Safety Engineer
Norton Co.,
Abrasive Div.,
Worcester, Mass.

ARC WELDING ELECTRODES

Sir:

Your May 13 issue contained tables on comparable arc welding electrodes for steel. Are equivalent tables available for electrodes for non-ferrous materials? If not, do you contemplate preparing such tables?

E. R.

● Comparable non-ferrous welding electrode tables are not available and we have no plans for preparing any. The reason is that there are no standards for non-ferrous rods on which a comparison of brands might be based.—Ed.

TEMPILSTIKS

Sir:

During the past year I have seen several references to a pencil of some kind which can be marked on metal and by the color of the mark will indicate the temperature of the metal.

I do not recall whether the same pencil mark will turn different colors at different temperatures or whether different pencils have to be used for different temperatures.

We would appreciate it if you would tell us where such pencils can be obtained.

S. A. STAEGE,
Consulting Engineer
Black-Clawson Co.,
Hamilton, Ohio

● Temperature recording pencils are known as "Tempilstiks" and are made by the Tempil Corp., 132 West 22nd St., New York 11, N. Y. They do not turn different colors at different temperatures (as do a new German type), but the mark they make on a piece of metal becomes fluid and assumes a glossy appearance when the rated temperature is reached.—Ed.

FORGED ADAPTERS

Sir:

Several weeks ago while looking through the April 15 issue of THE IRON AGE, I noticed an article by Lt. Col. J. H. Frye of the U. S. Army Ordnance on "Fuze Adapters Made By Forging."

This article, no doubt, was very interesting to a number of manufacturing concerns who have been unsuccessful in forging adapters. Every red-blooded American will agree, this is the only way to make adapters because of the steel that is saved. However, the process is not new, nor to the best of my knowledge has it been developed by the Army.

I know of one concern that has been forging adapters for more than two years, and has made more than a million and a half. They are working day and night, with orders ahead that will keep them busy for the balance of this year. This is a small company and one that is doing a remarkable job for the war effort.

This information is in no way intended to discredit the article of Lt. Col. Frye, nor the workings of the Ordnance Department, who are both doing a splendid job. I am writing this for your own information and to illustrate what a small concern, employing less than 100 men, is doing toward the war effort.

M. E. EYERLY
Bloomsburg, Pa.

● The fact that several small companies are turning out forged adapters was known to us, but we published the article so that others could profit by it.—Ed.

STEEL WANTED

Sir:

I am in the market for 3/8-in. and 7/16-in. round hard steel to make potato digger and other elevator chains. I have been unable to get this material where I used to get it. I used to order it under the name of spring steel.

If your CMP Simplifier and Priorities Guide can furnish this information, or if you can tell me where to get this material at a reasonable price, please pass me the information.

I have a preference rating of AA-2x for 7000 lb. of this material, but have been unable to find it.

JAMES THOMPSON
Thompson Mfg. Co.,
1328 8th Ave.,
Greeley, Colorado

● The CMP Simplifier and Priorities Guide does not tell where to get material, but does tell how to go about getting it. What you need is an allotment number. Apply to the Farm Equipment Division, WPB, Kittredge Bldg., Denver.—Ed.

TOOL STEEL DIRECTORY

Sir:

Will it be possible to obtain from you a book giving formulas on tool steels and drop die steels, etc.?

LUDWIG ANDERSON
164 W. 5th St.,
Erie, Pa.

● The Iron Age Tool Steel Directory contains this information. It is at present out of print, but a new edition is now in preparation, and will be ready within a few weeks. —Ed.

SEALING CAP

Sir:

A cellulose sealing cap is described on page 57 of your May 20 issue. This might be beneficial to us in our process within this plant. Can you give us the manufacturer's name?

R. N. MILLER,
Purchasing Agent
Allis-Chalmers Mfg. Co.,
Norwood, Ohio

● DuPont, Wilmington, Del.

HEAVIEST CASTING

Sir:

One of my radio listeners has asked, "What is the weight of the heaviest casting ever made in the world and where was it poured?" Any information you care to send me will be greatly appreciated.

ALBERT MITCHELL,
The Answer Man
P. O. Box 1213,
Chicago, Ill.

● The British say a 210-ton anvil block cast in 1867 in Sheffield by Nasmyth, Wilson & Co. is the largest; Bethlehem claims their 230-ton forging press cylinder jacket cast in the Lehigh plant in 1931 has the record. Tata in India also has made a claim the details of which we have forgotten. Has any reader a larger one?—Ed.

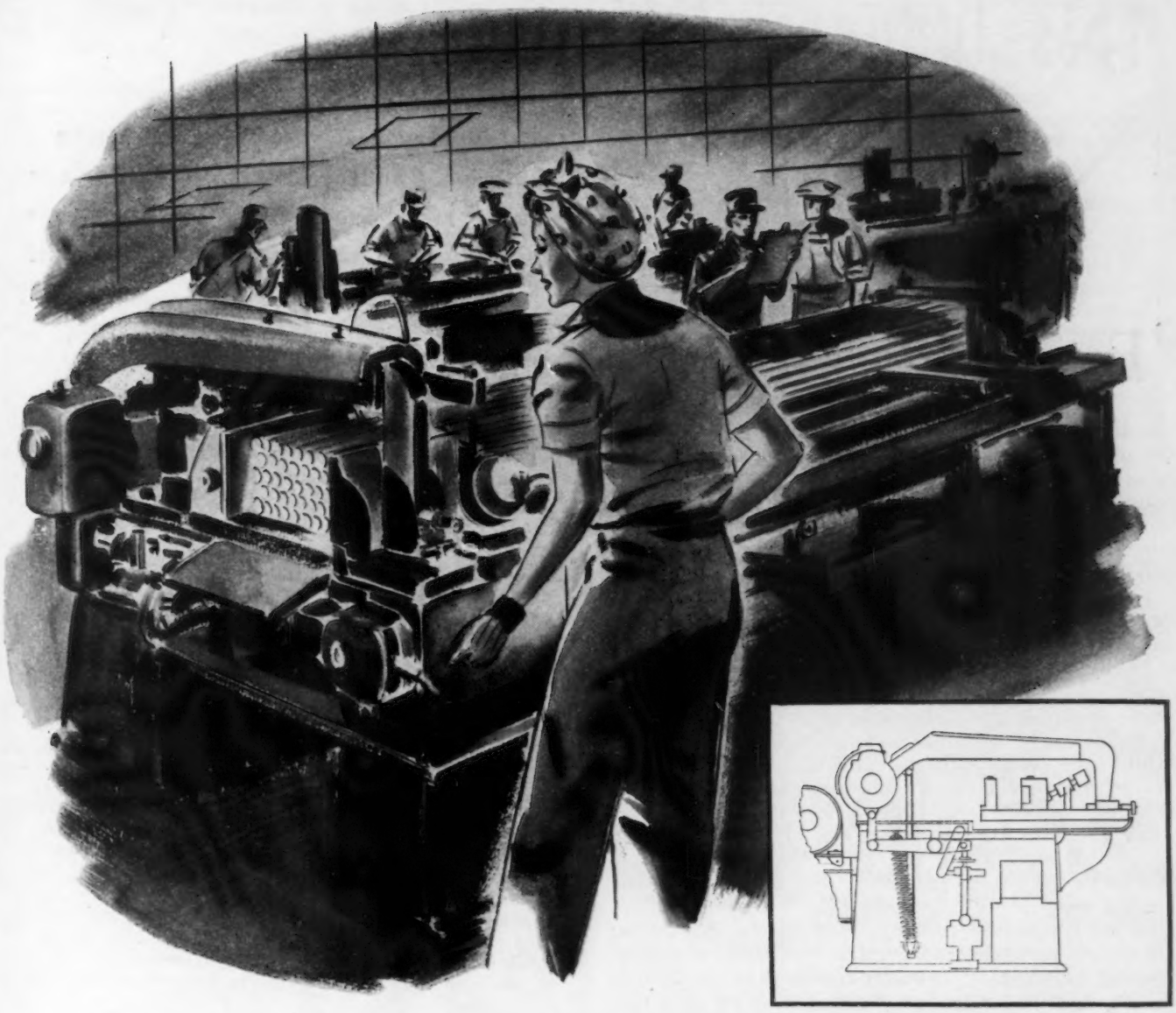
GAGE COMPARATOR AND PRIORITIES GUIDE

Sir:

Is it possible for me to obtain one copy of each of your Metal Gage Comparator and CMP-Priorities Guide?

JOHN A. WALKER,
Sales Engineer
Jessop Steel Co.,
Washington, Pa.

● The CMP-Priorities Guide is being sent you (price 25c in stamps). To secure extra copies of the Metal Gage Comparator, please communicate direct with the inventor, Ralph R. Bostic, 1312 Ingraham Street, Los Angeles.—Ed.



THE BIG JOB OF A LITTLE SPRING

IN MASS WAR PRODUCTION!

★ Seldom noticed, perhaps, is the counterbalance spring of the Racine High Speed Saw, shown above. But what an important part it plays in 24-hour-a-day production schedules!

Designed especially for this heavy-duty saw by Muehlhausen spring technicians, it is a vital part of the simplified finger-tip control, which speeds up production by cutting down handling and loading time. This spring has all the ruggedness to withstand the rough treatment of unskilled men, yet has the accuracy required for careful counterbalancing—so necessary for ease of manipulation by women operators.

You can always depend upon Muehlhausen to produce springs of unvarying precision and accuracy for any application; springs of any type—compression, extension, torsion or flat—hot or cold formed. Call, write or wire for facts today!

MUEHLHAUSEN SPRINGS
EVERY TYPE AND SIZE

MUEHLHAUSEN SPRING CORPORATION
Division of Standard Steel Spring Company
817 Michigan Avenue, Logansport, Indiana

SEND FOR TWO NEW FOLDERS—FREE

New Die Spring Bulletin illustrates, describes 206 sizes and types of die springs.

New Armament Bulletin shows importance of springs for many types of war equipment.

This Industrial Week.

- **Steel Industry Again Hit by Coal Strike**
- **Cumulative Effect of Walkouts Is Serious**
- **Drive for More Steel Aimed at Consumers**
- **Efforts Made to Shift New Mill Equipment**

THE coal mine strike, third walkout of the UMW in recent months to harass the steel industry, appeared likely to cause the irretrievable loss this week of 30,000 tons of steel. Even if settled speedily within a short time, the restoration of coal shipments and the resumption of full steel mill schedules cannot be accomplished immediately. Thus, the possibility of meeting the WPB demand for more steel in third quarter has been impaired. Plans for the drive are being held in abeyance pending the outcome of the strike.

Late on Tuesday one Valley blast furnace went down and six others in the Pittsburgh-Youngstown area were in the process of being taken off.

Fully as serious as the immediate losses is the cumulative effect of the mine disruptions upon next winter's stockpiles which should be growing higher at this time instead of dwindling to an all-time low point. The tight coke supply situation probably will be reflected through the balance of this year, and may result in lack of sufficient fuel to run some blast furnaces next Fall. This in turn will throw a heavier burden on scrap supplies. Then, too, the strike is expected to result in the loss of important coke by-products vital to the war.

Steel companies Tuesday were seeking to stretch their low stockpiles, hoping that the walkout will be settled before blast furnaces are banked on a large scale. Beehive production, counted upon by steel producers to supplement by-product coke, halted Sunday night. Six blast furnaces were scheduled to be taken out of production Wednesday at Pittsburgh and Youngstown and thirteen more on Thursday. Coking operations were likely to be down to 25 per cent at Pittsburgh by the week-end. It was estimated 18 hours would be required after the end of the strike before coal and coke would be flowing anywhere near normally.

COMING on the eve of a nation-wide drive under auspices of the OWM and WPB to increase war steel supplies sharply in third quarter, the blow by John Lewis's men endanger the success of the campaign. However, the endeavor has been slanted to take some of the burden off overloaded steel mill equipment by appealing to steel users to "share the steel" through putting excess inventories to work and relinquishing equivalent CMP allotments.

It is estimated that at least 300,000 tons of steel can be obtained from a nation-wide inventory study, 300,000 tons from stimulated production by existing facilities and 350,000 tons by expediting the expansion program for which the green light on priorities has been flashed. Stepping up the recovery of industrial scrap will be another valuable aid and standardization of steel products will be pushed farther.

Leaders of the steel workers' union are reported to view the campaign as a valuable opportunity for the USWA with its 700,000 workers. Outlaw strikes, absenteeism and red tape involved in administering WMC rulings have had more effect on steel output than generally supposed. In addition to last week's strike at the Bethlehem steel plant in Lackawanna, a small walkout hit the rail mill at the Gary works of Carnegie-Illinois Steel Corp., causing the loss of several thousand tons.

SLANTING the campaign (which was mapped out in Washington last week and was under discussion by steel executives Tuesday in New York) to include consumers and workers, shows recognition of the fact that finished steel cannot be made until the ingots have been broken down in the blooming mill, the main bottleneck to greater production today. Efforts are being made to shift equipment such as blooming mills and cranes to those plants which are in a position to use them quickest.

In the opinion of some steel industry experts, the coordination of new units coming into operation will present a problem. If coke production is not sufficiently along to supply a new blast furnace, there will be no use in rushing the stack into completion, and so on. In general, however, it is said that concentration on blast furnaces and auxiliary equipment including coke facilities probably will be most

"Complacency" Hit by Patterson

• • • Output for the Army ground forces, which constitutes about one-sixth of the war production program, declined in May 3½ per cent to $1,494,000,000, according to Robert P. Patterson, under-secretary of war, who attributed at least part of the recession to "complacency and overconfidence." Another authority said "we cannot afford another May." Airplane production rose to 7200 machines, 68 per cent of them tactical types. War production as a whole in May is estimated to have risen about 2 per cent.

News Highlights in This Issue

beneficial. As new furnaces come into blast, old ones will have to go down for long overdue repairs.

THE need for more steel was illustrated by J. A. Krug, of WPB, speaking at Detroit last week. Requests for carbon steel for third quarter, he said, exceeded 20,000,000 tons; supply was slightly under 15,000,000 tons, necessitating overall reduction of 25 per cent. The Army was cut 500,000 tons, the Navy 100,000 tons and the Maritime Commission, 400,000 tons. The Office of Defense Transportation, seeking 2,200,000 tons to meet expanding transit problems was shaved to 1,200,000 tons. Copper and aluminum were cut in "approximately the same pattern, the difference being that the situation in these metals is even tighter." Krug reported that 70 per cent of the carbon steel allocated for the third quarter was for direct military use—Army, Navy, Maritime Commission, Board of Economic Warfare, Lend-Lease, and Canada. An additional 18 per cent went for farm equipment, railroads, utilities, new building construction, oil wells, aviation gasoline plants and synthetic rubber plants. More than five per cent went to warehousing and maintenance, repair and operating supplies. (The railroads are reported to have asked for 68,000 additional tons for third quarter, over their original allotment.)

Mentioning these allocations, Krug reported that "we are running uncomfortably close to the danger line" in allotments for the petroleum industry, for utilities, for railroads and other essential services. The Petroleum Administration, for example, was said to have been allotted only around 300,000 tons of carbon steel for its overall program, including aviation gasoline, new pipe lines and drilling of wells. (Large numbers of vital components useful in the aviation gasoline and synthetic rubber programs are reported to be tied up following the cancellation of miscellaneous construction projects. Army regulations are declared a barrier to the speedy release of these motors, valves, controls and compressors.)

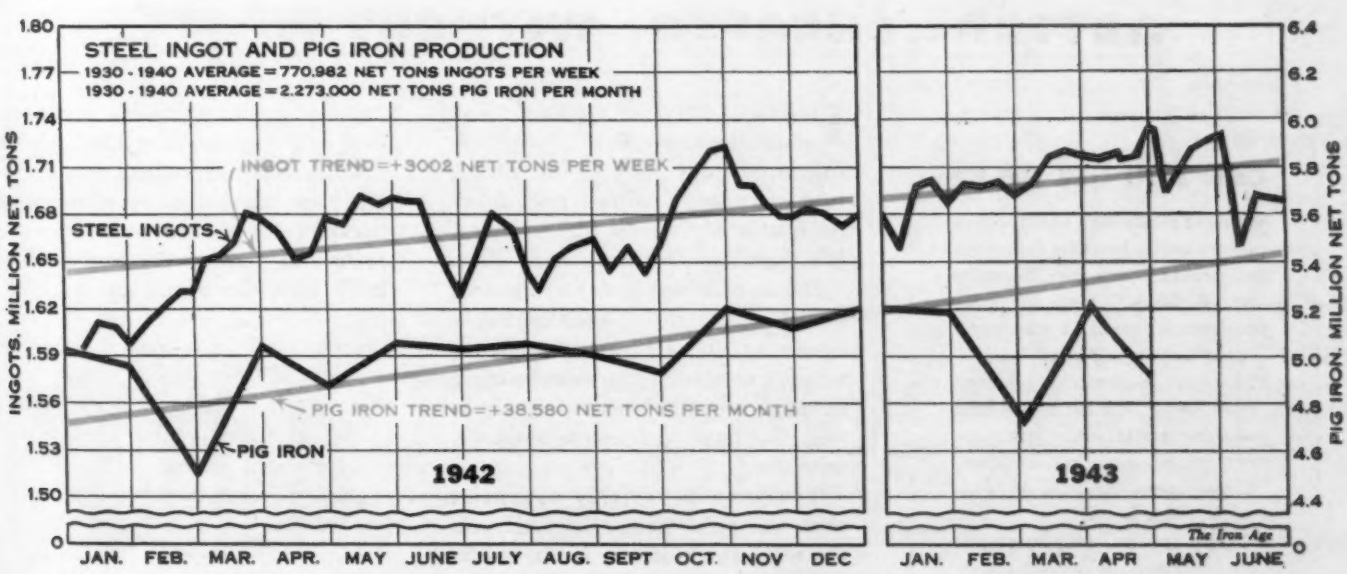
Steel Case Cited as "Marvel of War"

Chicago

• • • The development of the steel cartridge case is the "mechanical marvel of this war," declared Major Gen. L. H. Campbell, Jr., Army chief of Ordnance in a press interview here Monday. The steel case is "out of the woods," he said, and the problem now is to bring up the quantity being produced.

Asked what he considered the chief technical problem of the moment, Gen. Campbell said that it was the problem of keeping ahead of the Germans. Although he would certainly welcome any idea for increasing the explosive power of present explosives, he pointed out that present day explosives have about 30 per cent more power than TNT, but the Army could use still more powerful materials.

THIRD quarter tin plate production appears finally to have been set at 724,000 tons after it was scheduled originally at 705,000 tons, the gain representing recognition of pleas made by canners. Latest figures for the first four months of 1943 show that cold reduced tin plate, introduced in 1928, has completely supplanted hot rolled tin plate with the exception of a few mills or about one per cent of total tin plate produced. Now, another phase is under way. Spurred by the need to save tin, installation of 18 electrolytic lines and the construction of ten additional units seems to indicate that this newer process may make lasting inroads where heavy coatings can be dispensed with some electrolytic mills are reported to have slim order books.



Steel Ingot Production by Districts and Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	S.Ohio River	St. Louis	East	Aggregate
June 17	100.0	97.0	93.5*	93.0	96.5	104.5	89.0	102.0	100.5	102.0	100.0	99.0	113.5	97.5
June 24	95.0	97.5	94.0	93.0	98.0	104.5	89.0	102.0	103.5	102.0	109.0	99.0	108.0	97.5

* Revised

OWI Photo by Hollem

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Third Coal Strike in Recent Months Begins To Impair Steel Industry; Blast Furnaces Going Down

CRISIS BREWS: This scene occurred June 19 when miners at the Montour No. 4 mine at Lawrence, Pa., gathered between shifts to discuss the approaching strike truce deadline at midnight June 20.

NEWS OF INDUSTRY

Pittsburgh

• • • **For the second time** in two weeks and the third time in recent months, coal mine strikes started to make a serious dent in steel production in this area on Tuesday. About 19 blast furnaces were to have been banked here this week as a direct result of the coal strike. Stocks of coal at the Carnegie-Illinois Steel Corp. Clairton by-product plant early this week had reached an all-time low.

Far more serious to the steel industry as a whole is the cumulative effect of the previous mine shut downs as well as the current one. With coal demand expected to reach an all-time high of 600 million tons this year, losses which have occurred cannot be made up. This means a continuing tight coke supply situation which may be reflected in the lack of sufficient fuel to run some blast furnaces this Fall. A heavy burden will be thrown on scrap supplies.

The irretrievable loss of steel production two weeks ago mounted to about 50,000 tons and this loss came at a time when the government was making a plea to the steel industry to increase its output. It is believed that if the coal strike continues for the rest of this week, approximately 30,000 to 35,000 tons of steel production will have been lost.

Although only one major steel company here thought it would be affected this week as far as a loss in steel production was concerned, a strike lasting until next week will tell a far different story as other plants in the district will have to cut back by that time.

An authoritative estimate of the loss in steel production in case the coal strike runs for a week after this week forecasts one of the most serious disturbances to war production that has yet occurred under any circumstances. If the strike lasts through next week, there is a probability that so many blast furnaces will be forced down that the steel ingot rate in the Pittsburgh district might drop to 50 per cent of capacity which on a weekly basis would represent a loss of approximately 200,000 tons of steel. It is hoped here that the strike will be settled before that time comes.

Production Sagging

• • • Late Tuesday Carnegie-Illinois Steel Corp. began taking off six blast furnaces in the Pittsburgh-Youngstown area due to lack of fuel. By-product coke production at Carnegie's Clairton by-product plant had slipped off 40 to 60 per cent on Tuesday of this week and was scheduled to operate at 25 per cent of capacity on Wednesday.

Shenango Furnace Co. at Sharpsville, Pa., on Tuesday was forced to take off a blast furnace due to lack of coke. Struthers Furnace at Struthers, Ohio, was scheduled to go down Thursday of this week if coke is not available. Pittsburgh Steel Co. has cut back by-product coke operations.

By the middle of the week Jones & Laughlin Steel Corp. was scheduled to reduce wind on blast furnaces, although not banking them. The balancing of coal supplies and reduction of pig iron production at Jones & Laughlin will result in the loss of some steel.

Equally serious to the war effort is the loss of important coke by-products which are utilized in direct war uses. The strike of two weeks ago caused a decline in by-products from the coke oven and a decline in volume was in progress early this week as by-product coke production at some ovens was cut back.

The halting of bee-hive coke production Sunday midnight has struck a serious blow to many steel companies which count on this material to supplement their by-product fuel supplies. Practically all bee-hive production is needed urgently to make up for the overall shortage in coke.

Summing up the far reaching effects of the latest coal strike, regardless of whether it is of short duration or not, it can be said that—it has seriously impaired the possibility of meeting the WPB demand for an extra million tons of steel in the third quarter—it has depleted coal supplies at many mills to such a dangerous point that flood or serious cold weather conditions later in the year might have a secondary effect on steel production—it has brought the coke supply situation to a head making this one of the chief bottlenecks in producing additional steel and pig iron from new units to come in later—and it has seriously affected the morale of steel workers who may have to stand idly by with urgently needed steel plants shut down because of the coal stoppage.

2,000,000 Tons of Coal Lost Per Day

New York

• • • **Judging** from past results in the two work stoppages at coal mines previously suffered this year by war industries, the mine strike this week was causing the loss of 2,000,000 tons of coal per day.

During the first work stoppage immediately after April 1, the original expiration of the miners' contracts, some 16,000 tons of pig iron and approximately 20,000 tons of steel were irretrievably lost. The five-day stoppage ending June 5 cost at least 50,000 tons of steel, about 12,000,000 tons of coal and banked 13 blast furnaces within the first four days.

A spokesman for Carnegie-Illinois Steel Corp. reported on Monday a coking coal supply of only 1½ days at the company's Clairton ovens and foresaw at least a 25 per cent curtailment in both iron and steel production by midweek. Continued coal stoppage would curtail production as much as 75 per cent by this week-end, the spokesman estimated. In the United States Steel Corp. as a whole, a possible 25 per cent of blast furnace capacity could be cut-off by a week's coal stoppage plus the 5 per cent of total blast furnace capacity now out of production for repairs. Failure of steel production will closely follow the scale of pig iron loss, according to company officials.

At least one Alabama blast furnace of Republic Steel Corp. is almost sure of early banking.

Total national coal stocks, according to the National Coal Association, amount to about 75,000,000 tons or a little less than seven weeks' supply at the present consumption rate of about 11,000,000 tons per week by all industries. Much of this stock is represented by the huge stockpile held by public utilities.

The scrap trade which has been dull may also find a rapidly increasing demand from mills as a result of the coal strike as more blast furnace scrap will certainly be used due to its faster melting time and lower fuel requirement. Likewise with the hot metal supply already short in some steel centers, and with many blast furnaces off for repairs and many more likely to be taken off due to coke shortages, greatly increased open hearth scrap demand may be felt in an effort to keep steel production going without sufficient pig iron.

Beehive coke producers, always close to the deadline on coal supplies and frequently with inadequate storage facilities will be first to feel any stoppage and as many steel producers are relying more and more heavily upon beehive coke to augment their own by-product production, steel will immediately feel the cut-off. Some blast furnaces are entirely dependent upon beehive coke supplies and will cut-off within a day or two after coal deliveries stop. Seizure of coal in transit is expected to aid those caught with least coal and those operations most essential to continued production. However, such temporary relief could only carry over a few days for a very few emergency demands.

Renewal of the nation-wide strike, involving about 530,000 miners and between 3000 and 3400 coal mines, began Sunday after the collapse of negotiations between the United Mine Workers and the operators. Portal-to-portal pay was the principal issue. The miners, in a message which attacked the War Labor Board, told Secretary of the Interior Ickes they would work for the government.

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More Furnaces Expected to Be Banked

Cleveland

• • • **In the Ohio area** and in Alabama mills are preparing for immediate and drastic curtailment of iron and steel making operations. If the coal strike lasts seven days, blast furnace production in the Mahoning Valley area will drop sharply. Carnegie-Illinois Steel Corp. will be forced to bank furnaces at the Farrel and Ohio Works, and Shenango Furnace Corp., Struthers Iron & Steel Co., and Sharon Steel Co. will likewise have to curtail blast furnace operations. Republic Steel Corp. in the Valley area is short of coal for by-product coke production.

Youngstown Sheet & Tube Co., better off than other producers in the District, estimated that it has about a one month supply of coal on hand. During the previous two strikes, Youngstown reported from 2½ to 4 months supply, but steady drains on stocks with little replenishment, plus the fact that the company's stocks were shared with another company during one of the previous strikes has depleted them.

In the Cleveland area, American Steel & Wire Co. estimates an outside limit of six weeks on the coal supply. However, if pinches occur in other U. S. Steel Corp. plants in the vicinity, very likely to happen, coke from the wire company's Cleveland plants may be shipped elsewhere.

MINERS' DELEGATION: Representing a group of bituminous field miners this delegation walked bareheaded to the White House to present their demands to President Roosevelt. They were received by Marvin McIntyre, secretary to the president. Left to right they are: Leslie Dials, Roosevelt Miller, Joe Estep, S. H. Moore, Norman Wilson and Claude B. Campbell, chairman of the committee.

Drive for More Steel Aimed to Enlist Aid of Consumers and Workers

Washington

• • • **The WPB**, under the direction of Vice-Chairman Charles E. Wilson, started a nation-wide drive this week to effectuate the OWM order to sharply increase the supply of steel in the third quarter. Officially it was denied that an increase of 1,000,000 tons or any other specific goal had been set. Nevertheless, it is hoped to make available a supply equal to or even exceeding that figure assuming steel output is not slashed by a coal strike. Three principal sources are being relied upon to get the additional steel: (1) Putting excess inventories to work, (2) increasing production, and stepping up the recovery of industrial scrap.

The direct job of getting more steel is being done by the Steel Division, headed by H. G. Batcheller. The campaign was laid out in general terms at a meeting last Thursday between division officials and the steel advisory committee. Initiating the campaign, 12 officials from the Steel Division have left Washington to call upon as many WPB regional boards. The head of each board will organize staffs totaling between 200 and 350 representatives who will survey inventories at some 2000 consuming plants. Supervising this work is Norman Foy, assistant steel director. In addition, a campaign for improvement of management-labor cooperation will be made, while publicity in producing areas in the form of posters and placards will be used. Appeals will be made to consumers and workers alike by such slogans as "share the steel" and "steel for victory."

It was emphasized that it will be purely a sales campaign. Voluntary action will be depended upon to stimulate the steel supply.

No figures have been officially given regarding the increased steel supplies that it is hoped to dig up. But estimates have been made that at least 300,000 tons can be obtained from the inventory study, 300,000 tons from stimulated production by the existing facilities and 350,000 tons by expediting the expansion program for which the green light on priorities has been flashed. This makes an aggregate of 950,000 tons but some officials think that the expectancy from the inventory survey is far too small.

There is also a division of opinion concerning the increased supply that can be provided by production. Some steelmakers believe that as much as 1,000,000 tons' increased output can be developed by better organized worker morale and by expanded facilities. Other makers say that no such increased production is probable.

The inventory study, which it is estimated will take about one month to complete, does not contemplate the taking of tonnages from plants that are found to have excess supplies. Instead, it is proposed that third quarter CMP allotments for such consumers be invalidated, either wholly or in part. The invalidated tonnages would be transferred to claimant agencies, chiefly the Army, Navy and lend-lease which claim to be in urgent need of more steel, the great bulk of which will be high grade carbon material. While more alloy steel has been requested the belief prevails that the situation concerning this grade of material is fairly comfortable, particularly in view of the large additional capacity that soon will go into production.

The appointment of Theodore K. Quinn of New York as director general of the War Production Drive was announced last Friday. In this capacity he will give attention to steel, with other matters.

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Tower Cites Five Obstacles Which Are Hurdles In Drive for More Tonnage

New York

• • • **An industry-wide** effort by American steel producers to increase to even higher levels the present record output, barring long continuance of the coal strike, was announced last Tuesday by W. S. Tower, president of the American Iron & Steel Institute, following a meeting of steel company executives in New York.

"Possible ways and means of increasing production once the coal strike is out of the way were discussed by operating executives of 20 steel companies representing 90 per cent of the nation's steel capacity," said Mr. Tower. "Wherever possible, steps will be taken to speed up output in every phase of operations.

"This will require the closest cooperation between management and employees and the machinery for such cooperation is available through the Management-Labor Committees now functioning in steel plants."

It was recognized that substantial quantities of the additional tonnages wanted by WPB will be obtained from speeding new steel mill projects and more from unlocking oversized inventories believed to be accumulated at various places over the nation.

"For nearly three years the steel industry has been operating at close to 100 per cent of capacity," said Mr. Tower. "Capacity has been expanded in three years by nearly 10,000,000 tons to the huge total of approximately 91,000,000 tons.

"Yet tremendous as current production is, the industry is obliged to do everything in its power to meet the WPB request for higher tonnage. In addition to the coal strike the task is complicated by several obstacles to the maintenance of even the present rate of production. These must be hurdled before production can be increased. They are:

"(1) The epidemic of short, unauthorized strikes and work stoppages, the cumulative effect of which is to retard output.

"(2) Serious drains on skilled manpower through enlistments and the draft.

"(3) The blanket 48-hr. week which creates many practical difficulties which will have the effect of slowing down production.

"(4) Physical equipment of the industry has been strained to the utmost by 34 months of operation at 95 per cent or more of capacity, while time off for maintenance and repair was held to a minimum. The cumulative effect of this prolonged operation at forced draft is bound to reflect in periodic breakdowns.

"(5) Steel production normally falls off in hot months because of the effect of heat on workers' efficiency.

"If these hurdles can be overcome there seems to be no reason why the joint efforts of steel companies and their employees should not give maximum production for the war effort, although uncertainties of the situation make exact estimates of the increase impossible."

Consumption of Ore Was 7,373,972 Gross Tons in May

Cleveland

• • • **Consumption** by American and Canadian blast furnaces totaled 7,373,972 gross tons of Lake Superior iron ore during May, of which 7,168,788 tons went into American furnaces and 205,184 tons into Canadian furnaces. Total consumption to June 1, 1943, has been 37,152,722 gross tons, as against 34,907,133 tons during the same period in 1942.

New Appointments Give Labor More Power in War Production Board

Washington

• • • **Organized labor's** long insistence for a greater part in administration of the war effort was gratified last week when CIO Assistant President Clinton S. Golden, Pittsburgh, and Joseph D. Keenan, Chicago Federation of Labor (AFL) secretary, were appointed as WPB vice-chairmen and Mr. Golden was also made vice-chairman of WMC. Selection of Mr. Golden was said to have been prompted partly by the WPB program to secure cooperation of CIO's United Steelworkers in stepping up third quarter steel production.

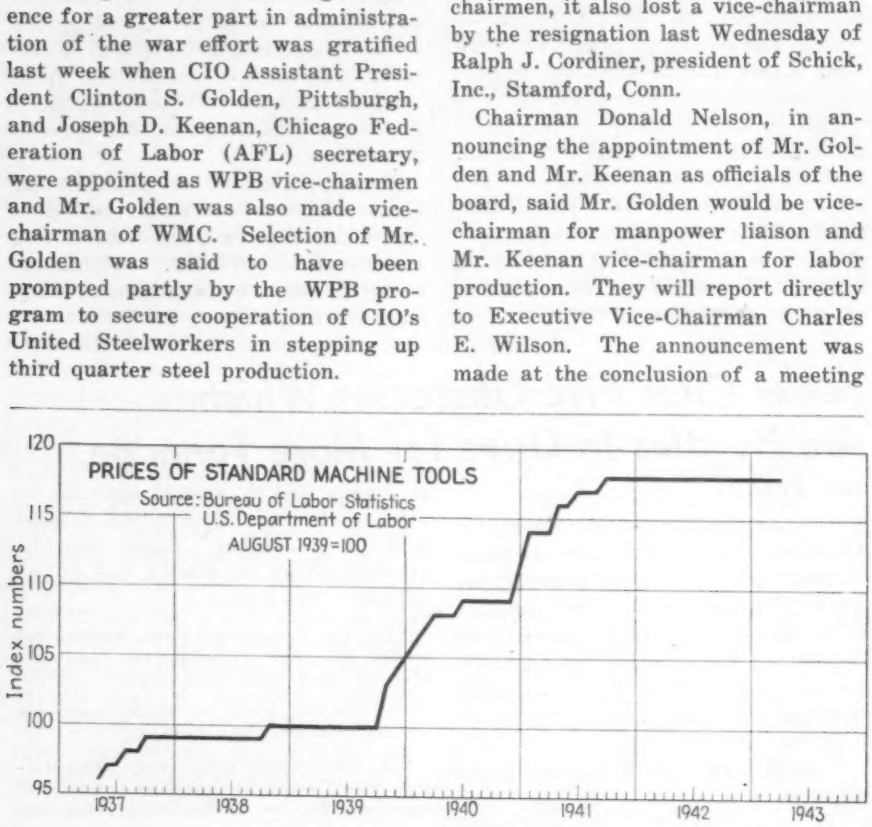
While WPB was adding these two labor leaders to its staff as vice-chairmen, it also lost a vice-chairman by the resignation last Wednesday of Ralph J. Cordiner, president of Schick, Inc., Stamford, Conn.

Chairman Donald Nelson, in announcing the appointment of Mr. Golden and Mr. Keenan as officials of the board, said Mr. Golden would be vice-chairman for manpower liaison and Mr. Keenan vice-chairman for labor production. They will report directly to Executive Vice-Chairman Charles E. Wilson. The announcement was made at the conclusion of a meeting of the WPB Management Labor Council.

It was also revealed that Mr. Nelson and WMC Chairman Paul V. McNutt have taken an unprecedented step to coordinate the work of their organizations and Mr. Golden will serve as vice-chairman for both.

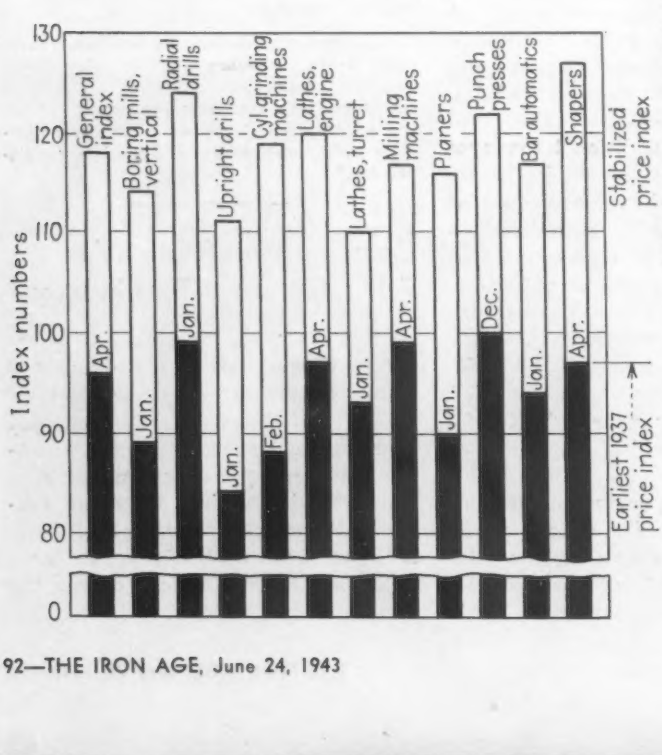
It was stated that Mr. Cordiner's resignation had no relation to the recent establishment of the OWM. In a letter of May 6 to Mr. Nelson, Mr. Cordiner, who was a trouble shooter for Mr. Wilson, said that he came to WPB originally with the intention of remaining only until April 1 but agreed to stay longer due to "internal organizational changes." Mr. Cordiner was director general for production scheduling originally and later was made vice-chairman and was assigned the jobs of reorganizing the facilities bureau and the statistics and planning divisions. The facilities job has been finished and WPB soon will announce the organization of a new bureau incorporating the functions of the planning and statistics divisions.

Wendell Lund, resigning last week as director of the Labor-Production Division wrote Donald Nelson a letter commending the appointment of Golden and Keenan to their new posts of authority in WPB.



Index Shows Machine Tool Prices Long Stabilized

• During the first quarter of 1943 the reported prices for 11 standard, general purpose machine tools remained unchanged at levels at which they were stabilized in September, 1941. The index is 118 per cent of the August, 1939 value (100). In April, 1937, the earliest date for which adequate data are available from the Bureau of Labor Statistics, the general index of machine tool prices stood at 96 (see line chart). Not all prices rose uniformly as the supplementary bar chart shows. The solid bars indicate the index numbers for the earliest month in 1937 for which data are available. The unshaded extensions indicate the present maximum stabilized price indices. The highest index of 127 is for horizontal shapers.



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Olds Upholds Value of Private Enterprise System

• • • **Business and industry** of the United States, through their production records, have provided a complete answer to critics of the system of private enterprise, said Irving S. Olds, chairman of United States Steel Corp., at the Waldorf-Astoria in New York, June 16, before 700 persons attending a showing of the corporation's new film which is titled, "To Each Other."

Private industry's mighty contributions to the war effort have revealed its live and potent force, said Mr. Olds. The success of American military forces, he added, can be traced to the mines, factories and transportation facilities of the nation—facilities which exist today and are successfully operating at or near full capacity for the security and future welfare of our country, because we have had in America for generations a system of free private enterprise which has permitted the development of our great natural resources, the establishment of the most modern types of mills and equipment and the training of highly skilled organizations to operate those plants."

Steel Union, with 700,000 Members, Sees Chance to Help Guide Production

Pittsburgh

• • • **Seven years ago** last week the CIO steel union was an idea and the steel industry with the exception of a few small plants neither recognized or had union contracts with organized labor. Last week on its seventh anniversary the CIO United Steelworkers of America had contracts and a check-off with practically every steel company in the country except American Rolling Mill Co. and the Weirton Steel Co.

Events were also shaping up last week indicating that the USWA at least had "its foot in the door" as far as sitting at the conference table with management on matters of production —a goal which Philip Murray, steel union head, has sought for some time. Since this is war and since there is little room for high-sounding and ambiguous speeches sprinkled with generalities, the USWA will now face a test of its ability to translate into action its claims that the union could speed and better war production.

The union's position on its bid to be consulted on matters of production involves the hope that management will recognize the worth of labor's counsel in production matters. It insists it has no desire to take away any of the fundamental prerogatives of the management group. Regardless of whether these claims hold water or not the steel union is certainly now in a position where it can no longer indulge in generalities but must "put up, or shut up."

Some of the top leaders in the USWA now hold positions in government agencies where their influence will be a factor in carrying on the war. Murray, along with Clinton S. Golden, Van A. Bittner, his assistants, and David A. McDonald, secretary-treasurer of the USWA, are members of the Labor Advisory Committee of the WPB Steel Division. Harold J. Ruttenberg, research director of the steel union, is now a special assistant to Hiland G. Batcheller, WPB Steel Division head. Mr. Ruttenberg is also active on the WPB Steel Requirements Committee. Philip J. Clowes, a USWA district director, is in the labor division of the WMC, while Mr. Bittner is a member of the War Labor Board. Recently the influence of the steel union moved up a notch when Mr. Golden was made vice-chairman of the WPB and the WMC to coordinate the labor aspects of the two agencies where conflict appears inevitable.

Opponents of organized labor claim that many of the appointments have had a political tinge, and that some of the plans and suggestions from USWA have not disclosed a knowledge of practical steel conditions. Some recent speeches and statements of men like Murray have, to some extent, supported this viewpoint. On the other hand, friends of labor, both in and out of the steel industry, look upon past performances as a means to an end and argue that once in a position where substantial and specific workable suggestions are required the union will either prove or disprove its real purpose in coming to the war conference table. The "Waterloo" in this test as far as the steel union is concerned will be the practicability and the reliability of its suggestions on how to increase steel production during the third and fourth quarters.

Steel management knows where the bottlenecks are and some of them are highly technical. Words will not produce steel and the lack of blooming mill capacity will still be a deterrent to breaking down any excess ingot output which may be realized. Management believes that outlaw strikes, even though lasting for only a day or two, plus absenteeism, plus red tape involved in administering WMC rulings, have had more effect on steel output than is generally supposed.

Labor, on the other hand, claims it has not had a realistic place in the war production picture until recently. On the matter of outlaw strikes and war stoppages some union leaders say that probably they and management have failed to instill the proper sense of reponsibility into the war worker down the line.

Here is the major argument on this question—the steel worker sees cutbacks in tank, plate, or bomb production, and sometimes loses one, two, or three days before schedules are rearranged—the employee, it is said, has been bombarded with the necessity for war production so he is confused by the cutbacks and sees little difference between this time off and the time taken off for "quickie" strikes in order to force an issue. While this argument may not be understandable to management and union brass hats, it probably carries more weight than is generally supposed. Nevertheless, the several hundred "quickie" strikes in the steel industry since the first of the year, with a large number in a short time at a Chicago plant, do have their effect on war production.

Other signs that the USWA is becoming a power and is pushing for collective bargaining on an industry-wide basis are found in its membership, which totals more than 700,000 workers in steel and closely allied plants. About 20 per cent of these men are in the armed forces. It is estimated that about 600,000 USWA members are having a dollar a month taken out of their pay for union dues, which means an income of about $7,000,000 a year. The district lodges are returned 25 per cent of these dues for their own use. Unlike many unions, however, the USWA issues a lengthy audit report giving the complete details on income and disbursements. The last one was issued in January and a new one is now in the making.

Despite the belief of a relatively few management leaders, the steel union is here to stay and it may not be long before it is bargaining collectively with the steel industry as a whole, similar to coal negotiations. Murray has been after this for some time and many steel companies see no particular objection to it.

SAFETY SHOE: Had it not been for his safety shoe this man would have lost two or more toes when the 800 lb. slab shown above fell on his foot from a distance of 18 in. The only damage was a dent in the steel tip of his shoe.

Tin Plate: Cold reduced, now 99 per cent of total output; Rapid growth in electrolytic next major phase . . .

Pittsburgh

• • • **In one** of the most rapid and remarkable changes in the steel industry, the production of cold reduced tinplate has, in less than 14 years, supplanted hot rolled tinplate. Only one per cent of the tin plate manufactured during the first four months of this year was made by the hot rolled process, and the mills producing this are located at one plant in western Pennsylvania, the Washington Tinplate Co.

This exceptional growth of cold reduced tinplate was made possible by the installation and perfection of continuous wide strip mills. They furnished the hot rolled tinplate coils which were cold reduced in tandem or reversing cold mills, sheared and tinned.

Just as this phase in tinplate has been completed, another one has been started with the installation of 18 electrolytic tinplate lines and ten under construction. Whether electrolytic tinplate will make rapid and great inroads into the hot dipped product remains to be seen. Lack of tin and war conditions, however, will be the determining factors in how far and how fast electrolytic tinplate will go in the next few years.

Cold reduced tinplate was pioneered at the Wheeling Steel Corp. and in 1929 only 0.2 of one per cent of total tinplate production was cold reduced. The change-over was quite slow from 1930 to 1934 when cold reduced tinplate amounted to about 13 per cent of total production. Increasing acceptance of the product and a greater number of cold mill installations resulted in a rapid rise in the participation of cold reduced tinplate from 1937 on.

By 1938 59 per cent of the tinplate made was cold reduced and in 1939 this percentage jumped to 75. In 1941 the participation was 89 per cent and war conditions apparently almost closed the gap in 1942.

Outstanding advantages which were preached for cold reduced tinplate several years ago included better surface and drawing qualities, closer tolerances, corrosion resistance, and a stiffness required by the changes in container manufacturing.

Growth of Cold Reduced Tin Plate 1929-1943

Year	Per Cent Cold Reduced of Total Production
1929	0.2
1930	1½
1931	3
1932	5
1933	8
1934	13
1935	24
1936	22
1937	36
1938	59
1939	75
1940	84
1941	89
1942 (estimated)	94
1943 (4 months)	99

Note—Data previous to 1938—The Iron Age. From 1938 on—American Iron & Steel Institute.

One of the advantages to steel companies which were in a position to make large scale cold mill installations was obviously a better cost factor owing to a greater utilization of continuous hot and cold mill equipment. Since most of the integrated steel companies made the bulk of the tinplate, they retired the older hot mill tinplate equipment as the new cold units were brought in.

When the European war broke out however, Lend-lease tinplate requirements were so heavy that many of the older hot mills were brought back into service in order to meet the over-all unprecedented demand. During the latter part of 1942, much of the existing hot rolled tinplate equipment was abandoned. Although some units are probably still standing, they will probably never run again.

As the second major tinplate phase involving electrolytic tinning gets under way, the question arises as to how far this will supplant the hot dipped product. There may be certain products which must use hot dipped tinplate with its 1½ lb. coating unless future developments include 1½ lb. electrolytic coating. On the other hand, a considerable tonnage of electrolytic tinplate will be used for products heretofore taking the heavier coating.

Estimates on electrolytic tinplate production for this year have been knocked into a cocked hat to some extent because of two reasons; first of which was the delay in installations owing to priorities, and the second of which is the resistance of packers to the use of electrolytic tinplate for some products until exhaustive tests have been made by can companies.

After being criticized in some quar-

Status of Electrolytic Tinplate Lines
June—1943

Company	Operating	Building No.	Est. Completion Date
Weirton Steel Co.	2	1	July, 1943
Crown Cork & Seal	1	0	
Bethlehem Steel Co.	2	1	July, 1943
Crucible Steel Co. of America	1	0	
Youngstown Sheet & Tube Co.	2	0	
Granite City Steel Co.	1*	0	
Jones & Laughlin Steel Corp.	1	1	July, 1943
Inland Steel Co.	2**	0	
Republic Steel Corp.	0	2	July and Aug., 1943
Wheeling Steel Corp.	1	0	
Carnegie-Illinois Steel Corp.	4	3	July-Sept.-Nov., 1943
Tennessee Coal, Iron & Railroad Co.	1	2	July-Oct., 1943
Total	18	10	

* On dull finish
** One line on dull finish

ters for tardiness in starting electrolytic production, the steel industry finds that some of its electrolytic lines now completed are or will soon be looking for additional business. Part of this situation is due to the fact that packers want to be sure that electrolytic tinplate will fill the bill on those items for which WPB has ordered the use of electrolytic. Probably the major reason for some of the slowness in the electrolytic production program is due to the fact that it is a relatively new process and one which many steel companies have had no experience with until within the past comparatively few months.

It appears that the WPB is seeking a compromise for the position taken by some packers in advocating 0.75 lb. coated electrolytic tinplate for certain items. The standard coating is 0.5 lb. and the price for this has been established at $4.50 per 100 lb. base box compared with $5.00 per 100 lb. base box of hot dipped tinplate. Carnegie-Illinois Steel Corp., it is understood, has filed a price of $4.65 for the 0.75 lb. coated electrolytic tinplate. Other companies, it is believed, will also file this price when and if they produce the product.

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Senate Committee Warns OWM On Weakness; Deems Failure Possible

Washington

• • • While "heartened" by the creation of the Office of War Mobilization, the Senate Subcommittee on War Mobilization in a second interim report to the Senate on Monday, said that if OWM follows in the weakness of its predecessors and confines itself to the adjudication of personal and agency disputes, it cannot but fail.

"Limited to adjudication," it was pointed out by the Committee, headed by Senator Harley M. Kilgore, Democrat of West Virginia, "this office will become an Office of War Mobilization in name only. It will then provide the appearance of centralized direction behind which the present disintegration of the domestic front will continue unchecked."

The setting up of OWM by executive order is held to have killed for the present at least the chance of passage of the Kilgore bill, (S 607) which, unlike OWM, provides for a War Mobilization Board composed of representatives of management, labor and agriculture and the public which "the direction shall advise and consult with . . . on all major policies." It would set up a civilian production agency with complete jurisdiction over the procurement and production functions now exercised by the military services.

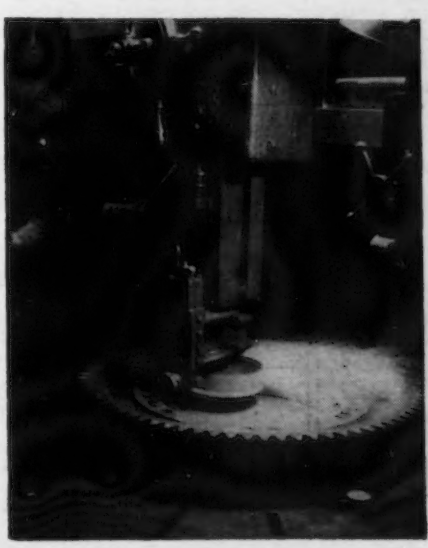
Labor witnesess before the committee strongly supported this proposal, and the committee intimated that, with support from these labor as well as industrial witnesses it would press for passage of S 607 if it thinks OWM falls down on its job. OWM, charged with effecting total mobilization, has been in existence an insufficient time, the report said, to study fully the problems involved or formulate the necessary plans. Being highly critical of the home front, the Committee said that production to date has been obtained by following peacetime practices which are causing disintegration on the home front and declared that only all-out production will unify the whole nation.

The first step, the report said, toward lifting the nation from the home front crisis was taken by setting up OWM but whether or not this will be more than a first step is now in large measures the responsibility of OWM Director Byrnes and his associates. Pointing to efforts of previous boards to establish an overall war program, the Committee said that their history proves that reorganizations without clear policy determinations are merely gestures.

The OWM, said the report, has all the necessary power to effect the total mobilization of "our production, resources and men" but admonished that it must eliminate contests for power or the maintenance of prerogatives that have been the cause of disintegration in the past.

"If the new Office of War Mobilization is to perform the function of over-all planning, active directing and unifying the component parts of the entire war effort, it requires as a basic minimum the participation of management, labor and agriculture. Active support rather than criticism and disagreement would be assured if representatives of these groups enjoyed close association with the Office's activities," said the report. "The committee urges that the Office of War Mobilization establish such a War Mobilization Board to meet at regular intervals and to participate in policy decisions."

INDUSTRIAL SPARKLER: Kicking up brilliantly is this Westinghouse machine, remodeled for war duty at the company's Nuttall Works in Pittsburgh. When a special internal grinder was required, a boring mill, not immediately needed for its normal duties, was converted quickly into an efficient grinder. The operator Frank Ley is grinding the counterbore on a ring gear for the wheel of an electric locomotive.



MORE WOMEN AT WAR: These women have taken the place of three men in the Tank Armor Ordnance Plant of Carnegie-Illinois Steel Corp. They are making a final check on a bullet-proof steel plate for a tank.

Complete Integration of PRP-CMP Seen Answer to Supply Coordination

New York

• • • **Practically complete** integration of CMP and PRP to attain perfect coordination of material supply and consumption is a suggestion made by G. A. Renard, secretary-treasurer of the National Association of Purchasing Agents. Citing the possibility for waste through lack of balance in the allotment of materials entering into the same program, some under CMP and others under M-order allocation, the suggestion proposes a broadening of the scope of CMP to include all materials controlled by both procedures under one simplified procedure.

Further pursuing this line of thought, Mr. Renard stated that quite possibly PRP could have been amended to do the job that CMP is doing now with the saving of considerable confusion and explanation. Laying the burden on industry of making the Plan work, Mr. Renard stated that fullest compliance throughout industry would do much to help simplify the plan and eliminate new rulings and red tape. Many of the reports and controls now required, he indicated, are the result of a need to control industry by legal force, whereas voluntary compliance could reduce or eliminate much paperwork and reporting. Another feature mentioned was the abuse of the MRO regulation by industry which may, as a result, cause extensive tightening-up of controls over MRO supplies above those already in force. Inventory compliance, likewise was cited as essential to the flow and balance of material supplies. These controls were placed by Mr. Renard at the door of industry for observance without WPB control if CMP is to be simplified.

A better synchronization of control over all materials that enter into war production was emphasized by Mr. Renard. Clarifying his statement, Mr. Renard referred to the discarded PD-25-A form which under PRP served to synchronize requirements for various materials and at the same time controlled and reported inventories. Alluding to the plight of a manufacturer trying to estimate his requirements for steel, copper, or aluminum without knowing what allocation to expect on other materials entering into his program, the advantages of a broader, completely integrated control over a greater range of materials is suggested utilizing some form such as PD-25-A adapted to CMP. Such a program was also suggested as an alternative to the revival of the full intended use of bills of material.

So far in CMP, relatively few bills of material have been requested, according to Mr. Renard, and it is presumed that sufficient information was on hand at WPB to permit estimation of actual requirements. However, since no one is aware of just what information was or is available on material requirements, the accuracy with which allotments are geared to actual specific programs is seriously questioned.

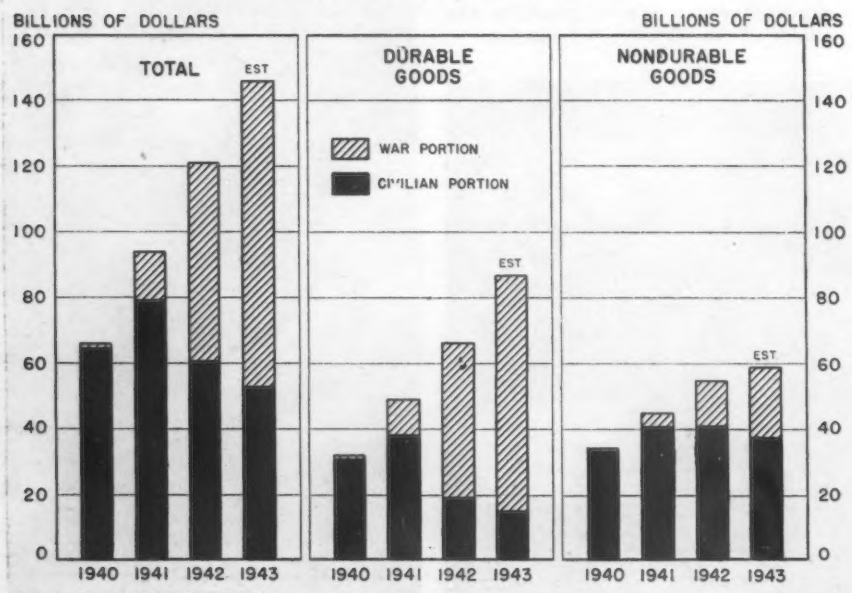
Other observers have pointed out that since CMP was actually a "checkbook" method of balancing supply with demand it is as important to know accurately the exact demand as the correct bank balance of materials available. Production directives based on capacity have established the supply angle fairly accurately but the true and actual demand may be inflated by lack of authentic demand figures such as would be supplied on the bills of material if furnished by all consumers.

On the other hand, even though the three primary controlled materials are accurately balanced with demand and properly allocated, other materials entering into the programs, if arbitrarily allocated, can throw a hitch in the entire program.

Evidence that WPB is not so sure of its facts and figures on either production of controlled materials or their consumption is seen in the recent activity by WPB toward obtaining more complete bills of material and also scouting trips throughout the country to determine whether producing facilities, supposedly nearing completion, are up to schedule. Much of this activity is attributed to the recent OWM demand for additional steel production this year.

INDUSTRY SURVEY: In three years American manufacturing industries have completed one of the most ambitious conversion jobs undertaken by a nation. In 1940, the year after war began in Europe, less than two per cent of sales were for war purposes. With the passage of the Lend-Lease Act, manufacturers' shipments of war goods constituted 15 per cent of total shipments in that year. In 1942 sales amounted to $121 billion of which 50 per cent was for war purposes. Total shipments of manufacturers for 1943 are estimated at $146 million, an increase of 20 per cent over 1942. The chart showing manufacturers' shipments was prepared by Bureau of Foreign and Domestic Commerce, U. S. Dept. of Commerce, as of April, 1943.

MANUFACTURERS' SHIPMENTS FOR CIVILIAN AND WAR USE



Replacement Orders Take Precedence Over Other CMP Orders on Schedules

Washington

• • • **The WPB ruled last** Thursday that orders for the replacement of controlled materials rejected by a customer because of non-conformity with specifications take precedence over all other orders.

Aluminum producers shall fill such replacement orders in preference to all other orders not in actual production on the day the replacement order is received. In the case of steel and copper producers, this ruling applies in the absence of specific instructions to the contrary with the Steel and Copper Divisions.

Controlled materials producers are instructed by Direction 16 to CMP Regulation No. 1 to replace the defective material without requiring the extension of an additional allotment and the customer is not required to charge the replacement material against an allotment, even if the replacement is made in a subsequent quarter.

In all cases, such replacements are not restricted by the provisions of paragraph (t) (4) and (5) which require that no authorized controlled material orders may be shipped if they are not filled within 30 days after the scheduled delivery date and a report made to the appropriate CMP Division. However, if steel producers cannot make delivery of the replacement order in time to meet the delivery requirements of the customer, they must immediately notify the chief of the appropriate production section of the Steel Division, in writing, giving a detailed explanation. If defective copper cannot be replaced in time to meet an authorized production schedule, or the delivery requirements of the customer, the producer must immediately notify the Copper Division in writing, giving all details.

Instructions for the disposition of rejected steel, copper and aluminum vary in some respects. The steel producer should attempt to make other use of the material to the extent permitted by applicable WPB regulations and orders. If this is not possible he should attempt to find other suitable uses and submit the proposed disposition to the appropriate production section of the Steel Division for approval.

Copper and aluminum rejections must be reported to the producer by the customer immediately. If the material is not scrap, the producer may direct that the material either be returned to him or shipped to another customer to fill any order which the producer is permitted to fill with new material under applicable regulations and directions. Copper scrap may not be disposed of except as provided by Order M-9-b. Aluminum scrap is handled in accordance with the provisions of Order M-1-d.

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Auto Men List Needed CMP Changes

Detroit

• • • **Problems on** CMP and industry's hopes for changes were outlined before the Priority Association of Detroit by Courtney Johnson, head of the Automotive Council for War Production materials control committee.

Some claimant agencies, he said, are still not balancing their allotments with production schedules, although both Army and Navy were reported as doing so. Navy and Army, he said, are agreed with industry's requests for longer-term programming, and have allotted materials as far ahead as July 1, 1944, in some contracts. Johnson said he believed that on all programs where military expediency was already determined, programs should be worked out a year ahead. On a tonnage basis, he said he believed this could be done on 75 to 80 per cent of the programs.

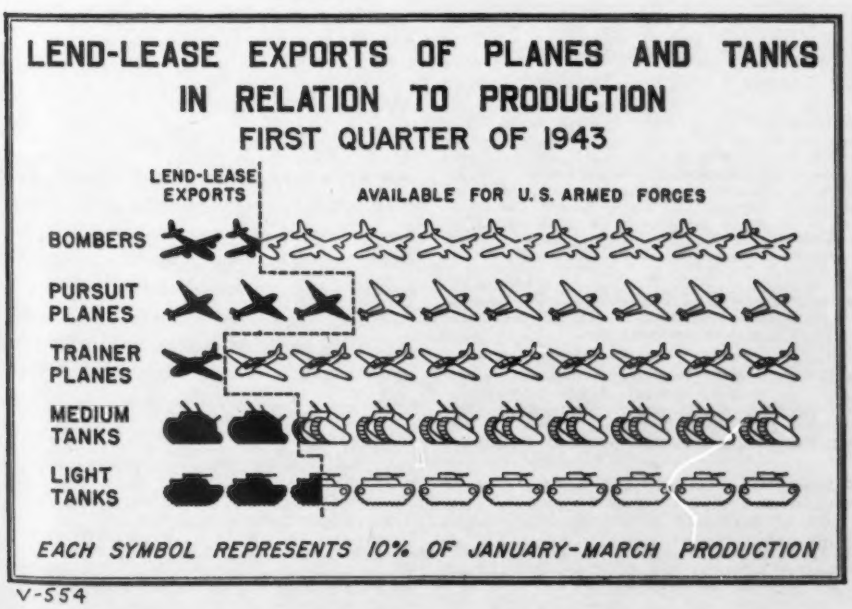
He listed these objectives of industry, currently being sought:

New bills of materials: Statements which would list all materials, not simply steel, aluminum and copper, and for both A and B products.

Simplification of the allotment and application procedure: Actual elimination of applications and allotments is sought, substituting instead the use of schedules for materials authorizations, with a prohibition against ordering more material than was required to meet the schedule. This, he indicated, was an impossible aim until full bills of materials are on file in Washington, probably not before the end of this year.

Less than mill quantity orders: The Automotive Council has suggested that mills must accept such orders and hold them for 10 days. If enough similar orders to make up a mill run quantity have not come in by that time, the mill would be required to run the minimum quantity, deliver the one order on hand and hold the balance for a limited time. If not disposed of in that period, the remainder would be sold to the Steel Recovery Corp. Johnson said he doubted that any such specific proposal would be accepted, but that he hoped for at least a counter-proposal.

Split ratings: The speaker bespoke belief that split ratings were unnecessary, that all ratings, in fact, should be unnecessary if CMP matches supply and demand. All ratings for one program, he said, should be listed on the same level, and Navy is trying to do this. Another problem is a rating for B products going into A products differently rated, a problem on which



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a solution is sought, pending which emergency ratings are being issued for the cases in this category which arise.

Product reclassifying: Johnson said he believed most B products should be handled on the A procedure when they are part of a major military program. He cited the example of a truck company producing military vehicles, for which the wheels are B products. Wheel applications were cut 30 per cent while the truck applications went through intact, to meet schedules. Had the wheels been listed as part of the A materials allotment, he pointed out, problems would have been avoided in such an instance.

Meanwhile, Detroit sources commenting on CMP generally are reporting that some Ordnance department contracts have been allotted completely through the second 1944 quarter. Navy was said to be moving in this direction; ASU was said to be stumbling badly.

The automotive community generally is quite cheered over the Direction to CMP Reg. 1 which provides that if a mill is unable to roll an order for the month specified, it must schedule the order in the earliest possible month, so notify the customer, and then follow through either on the approval or rejection of the re-timed schedule. The automotive company stand has been that the rejection of the order by an original mill meant lost time before another mill could be contacted, during which all rolling schedules for the month sought might be closed up. Under the directive, the purchaser at least is on the earliest possible mill schedule where steel was originally ordered, and still has the option of withdrawing from that month and trying to do better elsewhere.

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New Major Program Symbols Set

• • • **Certain alterations** have been made in the list of symbols for identification of the major CMP programs of Claimant Agencies since the information released and published on page 132 of the May 20 issue of THE IRON AGE. The following list shows symbols which have been altered:

Aircraft Resources Control Office

C-2 Ground and deck equipment and miscellaneous
C-4 Engines and accessories (including magnetos and carburetors)
C-6 ARCO—"B" products

Maritime Commission

M-4 Minor non-military vessels
M-5 Escort vessels
M-6 Aircraft carriers
M-7 Transport and other military vessels
M-8 Ship repair
M-9 Other equipment and supplies
M-0 Construction and facilities

Office of Lend-Lease Administration

L-3 Lend-lease areas other than those included in L-1, L-2 and L-4
L-4 Other British Empire, excluding Canada

Petroleum Administration for War

F-5 Hi-Octane expansion program

Office of Rubber Director

R-1 Construction and facilities
R-2 Special "B" products
F-4 Synthetic rubber expansion program

Office of Defense Transportation

T-5 Motor transport (Rubber-borne vehicles except buses)

Office of War Utilities

U-1 Miscellaneous utility-type "B" products
U-2 Utility construction and facilities and MRO

Office of Civilian Supply

S-2 Construction and facilities
S-5 "A" products and other

Aluminum Division (As Claimant Agency)

F-3 Aluminum and magnesium expansion program

Steel Division (As Claimant Agency)

F-1 Carbon steel expansion program
F-2 Alloy steel expansion program

CMP Developments

• Direction 17 to Reg. 1 gives brass mills holding authorized controlled materials orders which were scheduled for April delivery permission to fill such orders up until June 30 without specific direction, if production had advanced beyond the stage where materials can be diverted to other authorized controlled materials orders scheduled for May or later delivery. (Release No. WPB-3889)

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• Manufacturers of kitchenware now have to file separate applications for CMP materials required for their manufacture.

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• Direction 6 to Reg. 5 provides that ships under the flags of neutral nations may obtain maintenance, repair and operating supplies provided their needs are countersigned by the War Shipping Administration.

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• Reg. 5, as amended, provides that a preference rating of AA-1 may be used by producers of hardboard to obtain maintenance, repair and operating supplies, and a rating of AA-2 has been assigned to drainage and irrigation activities for obtaining MRO supplies. (Release No. TCS-64)

Priority Changes

E-6—Amended order makes wrenches, pliers, screw drivers and other mechanics' hand service tools more generally available to farmers, home mechanics and other ultimate consumers. (6-14-43)

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L-53-b—Amended order simplifies control in distribution of repair parts for track laying tractors. (6-19-43)

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L-65—Amended order provides for the manufacture of several more kinds of electric appliances for preferred orders, and for a limited production of certain kinds of heavy duty electric appliances for commercial civilian use. (6-18-43)

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L-83—Amendment removes control over certain food processing machinery. (6-17-43)

•

L-117—Amended order now brings into harmony the scheduling of manufacture of power and steam equipment with order M-293. (6-16-43)

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L-126—Amended order lightens restrictions on the production of industrial and commercial refrigerating and air conditioning machinery. (6-19-43)

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L-165—Amendment issued 5-19-43 revoked an original order reinstated without interruption. This order prohibits the manufacture of BX cable. (6-18-43)

•

L-246—Order now excluded of a ninth category of pumps which are those used in automobiles, trucks and similar vehicles as this type is covered in the automotive order L-158. (6-19-43)

•

L-250—Amended order makes a number of changes in the limitations imposed on the production and distribution of electric motor controllers. (6-16-43)

•

M-9-c—Amendment No. 1 approves the use of copper in the production of radio sets and parts for private use, when the manufacture of such products is permitted under order L-265. (6-16-43)

•

M-330—Supplementary Reg. No. 1 makes valves, pipe fittings and other farm supplies more easily available to farmers. (6-16-43)

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Priorities Reg. 3, Int. 3 provides that the term "fire protective equipment" as used in the regulation includes only end items and does not include materials or parts required for repair or maintenance of existing equipment. (6-18-43)

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WPB Eliminates Twenty-Three Offices

• • • **Twenty-three** of WPB's 123 district offices were closed June 15. Business formerly carried on by the twenty-three offices will now be handled by other district offices in the states involved and essential service to the communities will thus be maintained. These are the offices closed:

Lowell, Mass.; Fall River, Mass.; New Bedford, Mass.; Camden, N. J.; Chester, Pa.; Lancaster, Pa.; Norristown, Pa.; York, Pa.; Wilkes-Barre, Pa.; Reading, Pa.; Roanoke, Va.; Williamsport, Pa.; Chattanooga, Tenn.; Greenville, S. C.; Mobile, Ala.; Miami, Fla.; Johnstown, Pa.; Wheeling, W. Va.; Iron Mountain, Mich.; Fort Smith, Ark.; Shreveport, La.; Fresno, Cal.; Oakland, Cal.

Conference Clarifies Warehouse Pricing

Cleveland

• • • At an OPA conference here June 11, on changes in warehouse steel pricing methods, the working of the new warehouse zoning in six new zones was explained by E. L. Wyman, chief of the warehouse and jobbers section of the Iron and Steel Branch of OPA, Washington.

Under the new zoning system mill basing points have been established and schedules set forth definite basing point prices and standard extras, together with composite guide tables. While the base price and extras or deductions for identical products are uniform throughout any single zone of the 10 zoning areas, freight differences to various points within the zone eliminates the possibility of a single uniform delivered price to all consumers within the zone. However, OPA believes that the new pricing system will enable both warehouses and consumers to more easily calculate delivered prices under the OPA schedule.

One of the chief complaints with OPA warehouse pricing has been that distributors were frequently unable to calculate correct delivered prices under the former OPA pricing order because of the inability to get complete data on listed city selling prices. That caused frequent unintentional violations of the pricing order. Also, the clause on dislocated tonnages, for shipments of 150 miles in the direction of or beyond a listed city, or 350 miles in any one direction, caused trouble. The zoning systems reflects these deductions on inter-zone shipments rather than on a mileage basis from the shipping point. On inter-zone shipments, warehouse may sell at the zone destination price or absorb a $3 to $5 freight equalization, depending upon whether the shipment is a rail or other-than-rail delivery.

The delivered prices on merchant wire products; wire rods; water, oil country, and other pipe or tubing; tool steel; rails; track accessories, and a few other items, are not covered by the zone price structure and prices will be determined, as formerly, by the formulas covered by the applying sections in the revised pricing schedule.

The zone pricing system permits any authorized warehouse to sell at maximum delivered prices established in the amendment. Listed cities are eliminated in the amendment and free delivery areas are also eliminated.

An example in computing a delivered warehouse price follows:

A shipment of Cold Rolled Steel Sheets 18 ga.—36 x 106 in.—has been made from Pittsburgh (Zone 5), to Barboursville, West Va. (Zone 5), via truck. The gross weight of the stock material cut is 1860 lb.; the material is cut from 36 x 120 in. sheets; waste is shipped. The trucking charge actually paid is at the rate of $0.431 per 100 lb.

Section 1306.165, Appendix G (a) (7), governs the pricing of a shipment from a shipping point within a zone to a destination within the same zone.

COMPUTATION OF ZONE DESTINATION PRICE

Zone 5 Price Component Index and Dollar and Cent Components		
A. Basing point	A-1	Middletown
B. Price at basing point	B-4	$3.05
C. Freight	C-1	.33
D. Spread	$1.25	1.25
E. Quantity	E-6	deduct .10
F. Quality and merchandising	F-5	....
G. Size	G-10	.05
H. Cutting	H-2	.50
K. Miscellaneous	K-5	....
Zone destination price		$5.08

NOTE: F and K are not applicable; freight includes the Federal Tax of 3 per cent.

Table C-1 further provides that when the shipping point price plus freight from shipping point to destination exceeds the zone destination price by more than $0.30 per 100 lb. the freight shall be computed by using the higher of two alternatives. It is necessary, therefore, to compute the zone shipping point price, which follows:

COMPUTATION OF ZONE SHIPPING POINT PRICE

Zone 5 Price Component Index with Dollar and Cent Components		
A. Basing point	Pittsburgh	....
B. Price at basing point	B14	$3.05
C. Freight	C-1	....
D. Spread	$1.25	1.25
E. Quantity	E-6	deduct .10
F. Quality and merchandising	F-5	....
G. Size	G-10	.05
H. Cutting	H-2	.50
K. Miscellaneous	K-5	....
Zone shipping point price		$4.75
Plus freight from Pittsburgh, shipping point, to Barboursville, the destination		.391
Sum of price based on zone shipping point price plus freight		$5.141
Less zone destination price		5.080
Difference between shipping point price plus freight and zone destination price		$.061

The freight provision with its alternatives is not applicable as the shipping point price plus freight does not exceed the zone destination price by more than 30 cents.

Section 1306.165, App. G (a) (7), states that the maximum delivered price for shipments from a shipping point within a zone to a destination within the same zone shall be the zone destination price for that zone; therefore, the maximum delivered price to be used in this instance, as computed above, is $5.08 per 100 lb.

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Heat Treated Bar Ban Being Lifted

Washington

• • • Because they will soon be in better supply, WPB announced last Thursday that it had relaxed restrictions on delivery of heat-treated steel bars to warehouses. Effective Oct. 1, an amendment to Direction No. 5 to CMP Regulation 1 lifts the ban of April 19 on deliveries of the normalized or heat-treated bars to warehouses to reduce an excessive load on heat-treating facilities. After Oct. 1, warehouses will be permitted to accept deliveries on a restricted basis.

The amended direction, because of the long time cycle necessary for the production of normalized and heat-treated bars, permits warehouses to place orders immediately for delivery after Sept. 30. Co-incidentally, Direction No. 1 to Order M-21-b-1 (general steel warehouses) sets up the system under which warehouses will be permitted to accept restricted deliveries of these products after Oct. 1. Deliveries will be permitted to a warehouse in each month of the last quarter of 1943 equal to average deliveries from stock in the first four months of 1943.

Price Briefs

• Amendment 3 to Max. Price Reg. 351 clarifies the language of the order by providing that a sale or purchase of a ferrous forging includes both transactions in which the person producing the ferrous forging furnishes the materials and those in which all or part of the materials are furnished by the customer. (Release No. OPA-T-1037)

•

• Max. Price Reg. 2 in general reduces both scrap and secondary ingot maximum prices one cent per lb. below the ceiling previously established. (Release No. OPA-T-1048)

•

• Amendment 1 to Maximum Price Reg. 147 redefines the types of bolts, nuts, screws and rivets covered by the regulation. The amendment becomes effective June 22, 1943. (Release No. OPA-2663)

•

Whitridge to Head Industry Committee Office

• • • Appointment of John C. Whitridge, Jr., as Director of the Office of Industry Advisory Committees, succeeding Barry T. Leithead, was announced last week by Operations Vice-Chairman, Donald D. Davis. Before coming to WPB, Mr. Whitridge was Eastern division sales manager of the International Business Machine Co.

Ratings on MRO Orders Stand When Placed Prior to May 16

Washington

• • • **No down rating** of maintenance, repair and operating supply order is required, if such orders were placed prior to May 16, where an industry was reclassified to a lower rating by the amendment to CMP Regulation No. 5 on May 14, WPB announced last week. This provision is contained in Direction No. 3 to CMP Regulation No. 5.

The regulation assigns a blanket preference rating of AA-1 to MRO orders for activities listed on Schedule I; a rating of AA-2 to those listed on Schedule II; and an AA-5 rating to any business not listed. A business previously listed on Schedule I and shifted by the May 14 amendment to Schedule II must use the AA-2 rating, and if eliminated from either schedule must use the AA-5 rating, on orders placed after May 16.

•

New Class B List Issued

• • • **A revised Official CMP** Class B Product List, including a Class A Civilian Type End Product List, has been issued by WPB superseding the earlier Class B Product List published Dec. 21, 1942.

The list is substantially the same as the earlier list, but incorporates the following changes: (1) Air-borne Special B products have been deleted; (2) the previously carried partial list of maintenance and repair items has been eliminated; (3) a new category of Class A Civilian Type End Products has been established.

New Stack Is In At Lackawanna Plant

Buffalo

• • • **A new blast furnace with a capacity of 432,000 net tons a year was blown in June 18 at the Lackawanna plant of Bethlehem Steel Co. The furnace, to be known as "C," is a duplicate of "H" stock blown in at Lackawanna in November, 1941. "H" set a world's record last October, producing 46,246 tons.**

The new unit, which will produce about 1200 tons of pig iron every 24 hours, has a hearth diameter of 27 ft. and is 105 ft. high. Total volume is 46,706 cubic feet.

April Deliveries Extended To June 30 for Brass Mills

• • • **Brass mills holding** authorized controlled materials orders which were scheduled for April delivery are permitted to fill such orders up until June 30 without specific direction, if production has advanced beyond the stage where materials can be diverted to other authorized controlled materials orders scheduled for May or later delivery, WPB announced last week.

The direction makes clear, however, that such exception applies only where diversion is not possible. All other authorized controlled materials orders for brass mill products scheduled for April delivery unshipped by June 1 must be reported and may not be filled unless the brass mill is specifically directed to do so.

Unfilled Orders for Lists A, B, C Products Asked Cancelled

Washington

• • • **Preference ratings applied** to orders for specified items, which were not filled by June 4, must be cancelled if they are not in conformity with restrictions imposed on that date, WPB announced last week. The groups of items are specified in Lists A, B, and C of Priorities Regulation No. 3, as Amended June 4, 1943. The lists specify the products to which the various restrictions are applicable.

Ratings applied or extended to any outstanding orders for items appearing on Lists A, B, and C which are in violation of the restrictions must be cancelled, according to Interpretation No. 2 of that Regulation, if the orders were not filled by June 4.

Preference ratings have no effect on items appearing on List A of the Regulation. WPB desires to maintain a free market for such items. List B items may not be obtained with preference ratings assigned for maintenance, repair and operating supplies. The only preference ratings which may be used to purchase List C items are those assigned by the orders specified following the various items.

•

Export License Cost Not Allowable Expense

• • • **The OPA emphasized last week** that charges for securing export licenses are not extra allowable expenses under the Second Revised Maximum Export Price Regulation. Such expenses must be covered by the exporter's premium as provided for in the regulation.

While it is true that exporters did not incur the costs involved in obtaining export licenses prior to the war, the increase in premium over pre-war years allowed in the regulation was intended to cover such increased expense items, OPA said.

•

New Ruling Made on Ferrous Forging Prices

• • • **Ferrous forgings,** whether made from materials supplied by the producer or in part or entirely by his customer, are covered by the regulation on sales of ferrous forgings—MPR-351, effective June 21.

The amendment also added to the items excluded from coverage of the regulation pole line hardware and construction line specialties, which include such articles as anchor rods, guy fittings and steel crossarm pins.

United States Pig Iron Production in May

(Source: American Iron & Steel Institute)

UNITED STATES BLAST FURNACE CAPACITY AND PRODUCTION—NET TONS

	PRODUCTION						
	PIG IRON		FERRO-MANGANESE AND SPIEGEL		TOTAL		
	May	Year to Date	May	Year to Date	May	Year to Date	Percent of Capacity May
DISTRICTS:							
Eastern	934,176	4,653,617	24,687	110,014	958,863	4,763,631	87.7
Pittsburgh-Youngstown	2,150,137	10,543,548	13,456	94,650	2,163,593	10,638,198	99.0
Cleveland-Detroit	543,628	2,559,771	.....	.....	543,628	2,559,771	104.5
Chicago	1,087,583	5,381,126	.....	.....	1,087,583	5,381,126	97.9
Southern	344,969	1,704,297	13,939	87,587	358,908	1,791,884	95.5
Western	63,210	371,482	1,943	1,943	65,153	373,425	67.6
TOTAL	5,123,703	25,213,841	54,025	294,194	5,177,728	25,508,035	.2

During 1942 the companies included above represented 99.8% of the total blast furnace production.

In a recent letter from a lad at Guadalcanal to his former employer was voiced the greatest challenge of our time.

"What," he said, "am I, and all these fellows with me, going to do when this thing is over?" Is peace to bring with it the deadly spiral: men laid off and demobilized, hence less purchasing power, hence more plants closed down, hence more men laid off, hence — ?

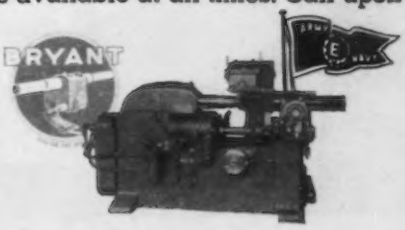
We believe we've seen the answer right on the production lines and right in the post-war plans of American industry.

We've seen and consulted with hundreds of research men uncovering new secrets in metallurgy, synthetics, plastics, aeronautics — finding new techniques and economies — planning new and wonderful products that will cushion the post-war interim to the greatest production age in history.

As internal grinding specialists, we at Bryant have already helped to solve production problems involving the machining of many new light metals, alloys, and synthetic materials including glass, plastics, hard rubber, wood, graphite, and even machine parts made of paper.

We've developed many new techniques in tooling, and we believe that this knowledge is important to your future. For that reason, our Consulting Service is available at all times. Call upon us now!

SEND FOR THE MAN FROM BRYANT...



Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.

Operating Expenses In Steel Show Gain Of 2½c. During 1942

• • • **Operating expenses** absorbed 96 cents of the American steel industry's sales dollar last year, 2½c. more than in 1941 and 5c. more than in the latest peace year of 1940, according to an analysis of data reported by a group of representative steel companies, the American Iron and Steel Institute reported recently.

After the subtraction of amounts for payrolls, taxes, raw materials, depreciation and depletion and all other costs of production 4c. remained of each sales dollar received in 1942. Of that remainder, 2½c. were paid out in dividends to stockholders, one-half cent was distributed as interest to bondholders, while the remaining penny was added to the companies' surplus as a reserve for future needs.

In 1941, costs of operation consumed 93½c. of each sales dollar. Dividends represented 3c., ½c. was accounted for by interest, while 3c. were left in the business as an addition to surplus.

In 1940, the proportion distributed to bondholders was twice as much as in 1942. One and one-half cents more of each sales dollar were paid out in dividends that year than in 1942, while 3c. more of each sales dollar were added to surplus.

The rise in operating expenses evident during 1941 continued in 1942. Payrolls increased from 33c. in every sales dollar to 36½c. Taxes rose from 11½ cents to 12½c. per sales dollar, more than three times the portion consumed by taxes in 1929 and almost double the figure for 1940 when only 6½c. in every sales dollar were absorbed by government.

The largest percentage increase in costs last year was in payrolls, which took 10 per cent more of each sales dollar in 1942 than in 1941. Taxes ranked second, increasing 9 per cent over the year before.

The percentage of each sales dollar accounted for by interest and dividend payments to investors and by additions to surplus was nearly 40 per cent less last year than in 1941.

Charges for the depletion of resources and the depreciation of plants and manufacturing equipment consumed 4½ cents of every sales dollar in 1942, the same share as in 1941.

Costs of materials, freight charges and other expenses reflecting indirect labor costs took 42½c. of each sales dollar in 1942, two cents less than in the preceding year.

Speed up Production

WITH THIS NEW Sav-way MODEL M-H-2 INTERNAL GRINDER

OFFERS both hand and hydraulic table operation . . . each independent of the other . . . a new and exclusive Sav-way feature . . . permits use of both hand and hydraulic feed in combination on the same job in the same setting . . . other special features that help speed up production . . . send for literature giving details and complete specifications.

Sav-way INDUSTRIES

Machine Tool Division

4867 EAST EIGHT MILE · DETROIT, MICHIGAN

New Guide to Regulations and Personnel; Office of Price Administration

• • • Here are OPA divisions and commodities indexed alphabetically and according to price branches. The following reference guide is divided into three main divisions for readers of THE IRON AGE, namely; Iron and Steel, Non-Ferrous Metals, and Machinery. Under each of these broad classification the individual products are indexed alphabetically. With this reference is furnished the OPA division and personnel in charge complete with telephone number and also the Price Regulation number for accurate reference to the official text.

To simplify the listed material the OPA Divisions, the personnel in charge and their telephone numbers are given immediately below with a key number for identification with the listings of products.

Personnel Key

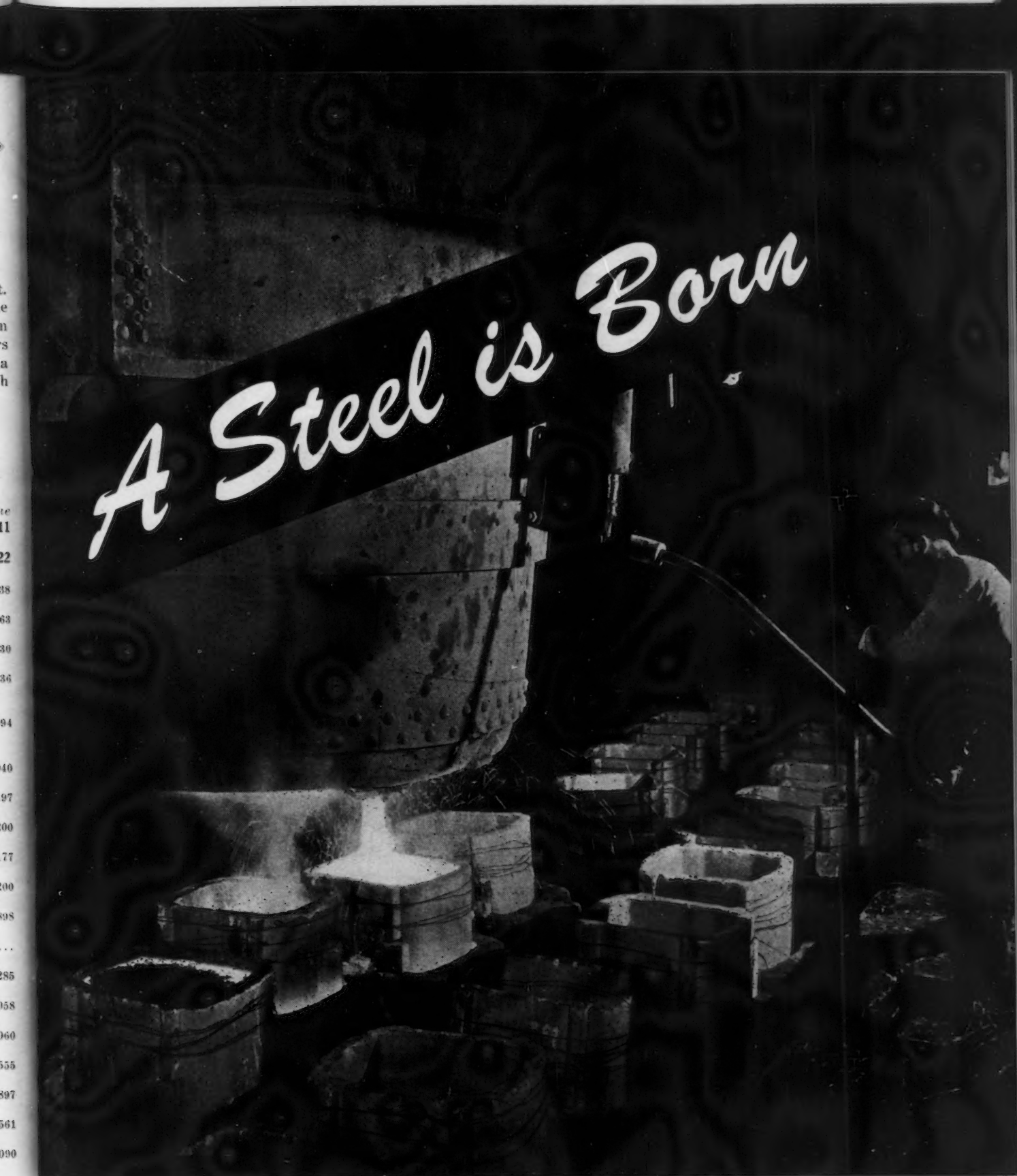
(Phone numbers are extensions of REpublic 7500 in Washington)

Non-Ferrous Metals Price Branch

		Phone
	John D. Sumner, Price Executive	6811
	Hugh N. McDiarmid, Administrative Officer	2022
(55)	Basic Metals and Mining Section, Oliver C. Lockhart, Head	6038
	Aluminum and Magnesium Unit, Alwyn A. Throckmorton, Head.	4663
	Mining and Smelting Unit, Frederick Holder, Head	6030
	Precious Metals Unit, John O. Coff, Head	74736
	Copper, Lead, Zinc, and Other Basic Metals Unit, Clarence Tow, Acting Head	6094
(56)	Fabricated and Mnufactured Products Section, Orrin McCorison, Head	6040
	Foundry Products Unit, Joseph B. Meier, Head	4197
	Machine Products Unit, David Laine, Head	6200
	Mill Products Unit, Frederick Jussen, Head	6177
	Manufactured Products Unit, David Laine, Acting Head	6200
(57)	Scrap and Secondary Metals Section (Vacancy)	6898
	Copper, Brass, Bronze, Nickel and Ingot Unit (Vacancy)	...
	Zinc, Lead, and Tin Unit, Kurt J. Rahlson, Head	6285
(58)	Ferro Alloys Section, Glen I. Degner, Head	6058
	Chromium and Vanadium Unit, Raymond Stickney, Head	6060
	Ferrosilicon and Manganese Unit, Wylie McKinnon, Head	4555
	Tool Steel Scrap and Cobalt Unit, William Sterling, Head	6897
	Tungsten and Molybdenum Unit, Peter Reinertson, Head	72561
(59)	Minerals and Minor Metals Section, Philip Woolfson, Head	6090
	Minerals and Products Unit (Vacancy)	...
	Minor Metals and Products Unit (Vacancy)	...
	Fred Wolf, Jr., Chief Counsel	6417

Iron and Steel Price Branch

	Donald D. Kennedy, Price Executive	6201
	William T. Wolfrey, Jr., Administrative Officer	74701
(60)	Basic Materials Section, Dexter A. Tutein, Head	6713
(61)	Scrap Section, Cornelius D. Scully, Jr., Head	6122
(62)	Steel Mill Products Section, F. Russell Widmer, Head	4591
(63)	Castings Section, Robert R. Horner, Head	75858



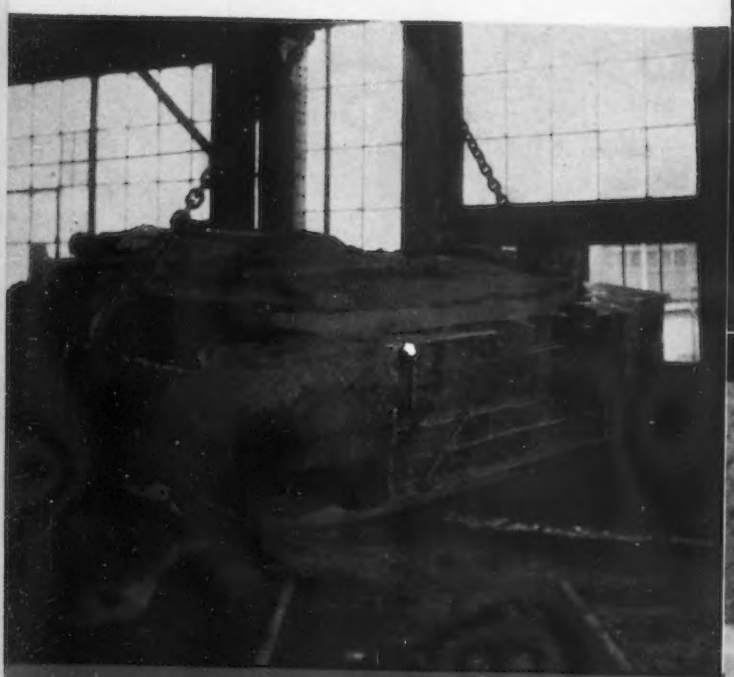
Pouring the first heat of a new "A.W." Alloy Steel is a moment to long remember. The promise of Victory and the vision of a better America are in every hot top ingot. Our first thought today is to produce the best steels possible in the greatest volume for ships, tanks, guns or the equipment which produces them. If you are engaged in war production and have an alloy steel problem, we will do our best to help you. Personal attention has been the keynote of "A.W." service since 1826.

ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS: CONSHOHOCKEN, PENNSYLVANIA : SINCE 1826. District Offices and Representatives: Philadelphia, New York, Boston, Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, St. Paul, New Orleans, Pittsburgh, Roanoke, Sanford, N. C., St. Louis, Los Angeles, San Francisco, Seattle, Montreal.

Look

ON YOUR FOUNDRY FLOOR



This machine tool casting is on its way to the Hydro-Blast room where the cores will be knocked out and surfaces cleaned to a satiny finish.

This pile of sand which originally cost more than $3.00 per ton can be washed, classified and dried by Hydro-Blast for 70 cents per ton.

There you will see a fortune in used core and molding sand, recoverable by the Hydro-Blast system which is already relieving our overtaxed transportation facilities from hauling millions of tons of foundry sand.

The sand on your foundry floor represents a minimum cost to you of $3.00 per ton. Hydro-Blast may reclaim 85 percent of that sand for 70 cents per ton. As cores and surfaces are Hydro-Blasted, the sand is washed, classified and dried to the desired moisture content and returned to the heap, thereby transforming a distinct liability into a profit that usually pays for the investment in Hydro-Blast within one year.

Hydro-Blast employs wet sand and water to knock out cores, surface clean castings to microscopic cleanliness and remove imbedded sand particles, so that chipping, grinding and machining costs are greatly reduced. Two unskilled laborers and Hydro-Blast can do the work of ten sand chippers, and do it far better, while releasing eight men for other highly essential work.

Hydro-Blast also makes a direct contribution toward more healthful working conditions. In every foundry where "before and after" dust counts have been made, it has been found that the atmosphere in the Hydro-Blast room, as well as the surrounding atmosphere, is cooled and cleansed to a marked degree.

Today, more than fifty Hydro-Blast systems are working for such outstanding foundries as Ford Motor, Symington Gould, Joshua Hendy Iron Works, Worthington Pump, American Manganese Steel, and a host of others.

Foundry executives and engineers who are not familiar with Hydro-Blast's efficient, economic and hygienic advantages, will be given free information on request.

This is the same machine tool casting shown above after Hydro-Blast had knocked out the cores, scrubbed the surface and recovered the sand.

THE HYDRO-BLAST CORPORATION

2550 North Western Avenue • Chicago

(64) Fabricated Products Section, Weldon Welfling, Head 72579
(65) Warehouse and Jobbers Section, Everett L. Wyman, Head 2024
(66) Reusable Products Section, Sam M. Ewing, Head 5925
Bernard M. Fitzgerald, Chief Counsel 4136

Machinery Price Branch

T. J. Kinsella, Price Executive 4121
Wellington D. Jones, Jr., Acting Administrative Officer 73657

Phone

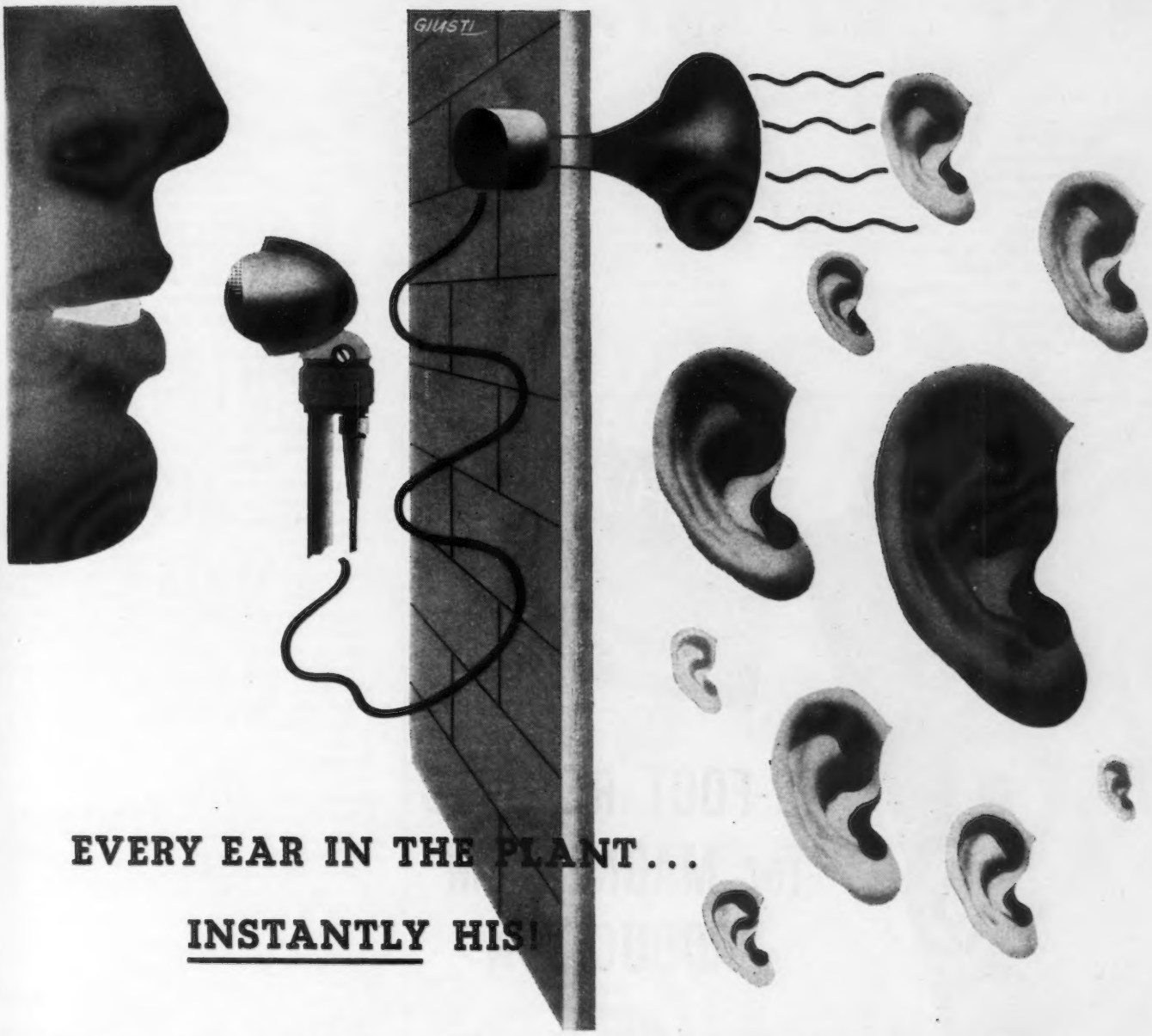
Heavy Machinery Section, D. V. Booz, Head 2843
(37) Construction and Extraction Equipment, Walter Shoemaker, Head 5167
(39) General and Auxiliary Machinery Equipment, Paul K. Miller, Head 5510
Machine Tools and Electrical Section, T. J. Kinsella, Acting Head 4121
(40) Machine Tools, John J. Rodgers, Head 6193
(41) Electrical Generating and Power Equipment, Frank R. Byrne, Head 2820
Parts Distribution and Transportation Section, William F. Kelly, Head 73845
(42) Machine Parts and Sub-Assemblies, C. C. Ostrom, Head 4330
(43) Automobile and Distribution, Harvey W. Huegy, Head 2451
(44) Transportation Equipment, Charles F. Munroe, Head 2605
John N. Cole, Acting Chief Counsel 5523

o o o

NON-FERROUS METALS

Industrial Materials Price Division Non-Ferrous Metals Price Branch

Commodity or Service	*OPA Div.*	*Price Reg. No.*
Alumina	(55)	GMPR
Aluminum and aluminum alloy ingots and pigs, primary	(55)	GMPR
Aluminum and aluminum alloy ingots, secondary	(55)	2
Aluminum bronze ingot	(57)	202
Aluminum bronze powder	(57)	GMPR
Aluminum bronze scrap	(57)	20
Aluminum: flaked, granular, and grained	(55)	GMPR
Aluminum mill products: plates, rods, sheets tubing, forgings, bar, foil, wire, and extrusions	(56)	GMPR
Aluminum oxide (abrasive grain)	(59)	GMPR
Aluminum powder (except aluminum bronze powder)	(56)	GMPR
Aluminum scrap (except foil and light-gage sheet)	(55)	2
Aluminum scrap: foil and light-gage sheet (0.006 in. thick and under)	(55)	GMPR
Ammonium molybdate	(58)	GMPR
Anodes, cadmium	(55)	71
Anodes, copper	(55)	GMPR
Anodes, zinc	(55)	GMPR
Antimonial lead: primary, secondary	(57)	70
Antimony metal	(55)	GMPR
Antimony ores and concentrates	(55)	Exempt
Antimony oxide	(55)	GMPR
Antimony, residues of	(55)	Exempt
Aplite	(59)	327
Babbitt metal	(56)	GMPR
Babbitt metal, residues of	(57)	GMPR
Barite (barytes or barium sulphate)	(59)	327
Barium metal	(59)	GMPR
Battery lead, scrap	(57)	70
Bauxite	(55)	Exempt
Bearing metal	(56)	GMPR
Bearings: nonferrous, friction (including babbitted)	(56)	GMPR
Bentonite	(59)	327
Beryl ore	(55)	Exempt
Beryllium and beryllium alloys	(55)	GMPR
Bismuth	(55)	GMPR
Bleaching clay	(59)	GMPR
Boron	(58)	GMPR
Boron carbide (abrasive grain)	(59)	GMPR
Brass and bronze alloy ingots	(57)	202
Brass and bronze deoxidizers and hardeners	(57)	GMPR
Brass mill products: plates, rods, sheets, and tubing (brass, bronze, copper)	(56)	GMPR
Brass mill scrap (brass, bronze, copper)	(57)	12
Brass scrap, other than mill scrap	(57)	20
Bronze ingots	(57)	202
Bronze plates, rods, sheets, and tubing	(56)	GMPR



EVERY EAR IN THE PLANT...

INSTANTLY HIS!

"Mr. Harker, please! . . . Washington calling . . . report at once to plant manager."

"Calling Mr. Thomas . . . please attend meeting at production engineering office immediately."

★ ★ ★

What a savings in manpower . . . what a savings in valuable time . . . when messages are delivered by Straight-Line Communication!

It does the job **QUICKER** and **BETTER** than by any other means . . . and the man-hours it saves more than pay for the installation in an amazingly short period of time.

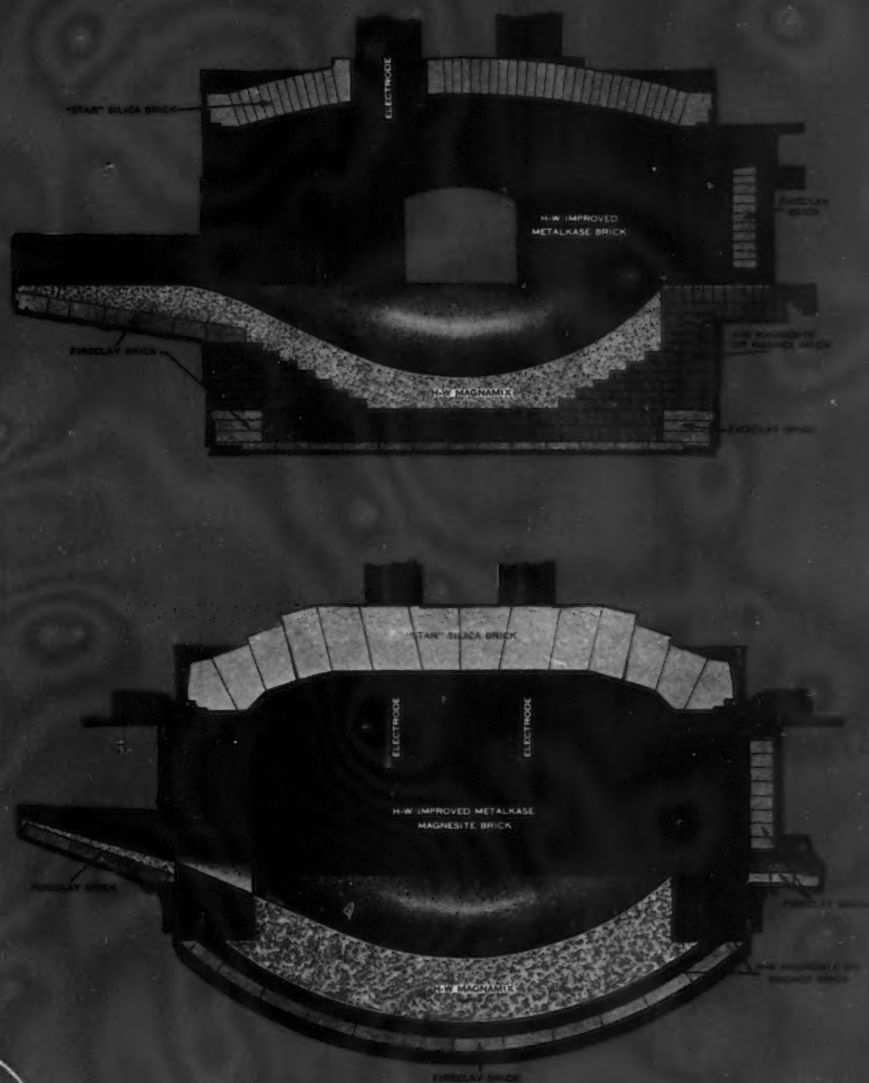
For 49 years Stromberg-Carlson has been developing the finest type of sound reproducing equipment. Why not let us show you how we can solve your own communication problem? Get in touch with the Sound Systems Division of the Stromberg-Carlson Company, 100 Carlson Road, Rochester, New York. Write for free Booklet No. 1937.

STROMBERG-CARLSON

STRAIGHT-LINE COMMUNICATION SAVES MANPOWER • SPEEDS THE WORK TO VICTORY

Commodity or Service	OPA Div.	Price Reg. No.
Bronze scrap, other than brass mill scrap	(57)	20
Bullet jacket cups for small arms ammunition	(56)	GMPR
Bullet rod or wire, lead	(56)	199
Busbars, copper	(56)	GMPR
Bushings: brass, bronze	(56)	GMPR
Cadmium, metallic (primary, secondary): anodes and special shapes; bars, sticks, and other straight or flat forms	(55)	71
Cadmium scrap	(57)	GMPR
Calcium	(59)	GMPR
Calcium aluminum silicon	(58)	GMPR
Calcium manganese silicon	(58)	GMPR
Calcium metal	(58)	GMPR
Calcium molybdate	(58)	GMPR
Calcium silicon	(58)	GMPR
Calcium tungstate	(58)	GMPR
Cartridge case cups for small arms ammunition	(56)	GMPR
Casting copper	(55)	15
Casting metal, lead base	(56)	GMPR
Castings, nonferrous: sand, cement, plaster, permanent mold (except die-casting), centrifugal, and slush	(56)	125
Castings, nonferrous: tin, bismuth, cadmium, cobalt, copper, brass, bronze, aluminum, antimony, magnesium, zinc, lead, nickel, monel, and beryllium	(56)	125
Cathodes, copper	(55)	15
Chrome ore (chemical, metallurgical, and refractory)	(58)	258
Chrome steel scrap (high alloy)	(57)	8
Chromium briquettes	(58)	GMPR
Chromium metal	(58)	GMPR
Chrom-x (high and low carbon)	(58)	GMPR
Cobalt, crude	(58)	Exempt
Cobalt metal: fines, granules, powder, rondelles	(58)	GMPR
Cobalt-nickel oxide	(58)	GMPR
Cobalt oxide: black, gray	(58)	GMPR
Collapsible tubes: lead, tin	(56)	GMPR
Columbite	(59)	GMPR
Columbium	(59)	GMPR
Condenser films, mica	(59)	GMPR
Copper-base alloy ingots	(57)	202
Copper-base alloy shot	(57)	GMPR
Copper, blister	(55)	Exempt
Copper, casting: ingot bars or small ingots	(55)	15
Copper: electrolytic, lake, and other fire-refined types (wire bars, ingot bars, etc.)	(55)	15
Copper-nickel shot, secondary	(57)	8
Copper ores and concentrates	(55)	Exempt
Copper plates, rods, sheets, tubing, strips, and pipe	(56)	GMPR
Copper scrap and copper alloy scrap, other than brass mill scrap	(57)	20
Copper shot	(57)	GMPR
Cryolite	(59)	327
Cupro-nickel scrap	(57)	8
Diatomite (diatomaceous earth)	(59)	327
Die cast scrap	(57)	3
Die castings	(56)	GMPR
Dies, diamond (.002 in. and larger)	(56)	GMPR
Dies, diamond (under .002 in.)	(56)	Exempt
Drawn shapes: copper, aluminum, brass, lead, and bronze	(56)	GMPR
Dumortierite	(59)	327
Extruded shapes: copper, aluminum, brass, bronze, tin, and lead	(56)	GMPR
Feldspar	(59)	327
Feldspar fire extinguishers	(59)	321
Ferroboron	(58)	GMPR
Ferrochromium	(58)	GMPR
Ferrocolumbium	(59)	GMPR
Ferromanganese: low and medium carbon	(58)	GMPR
Ferromanganese, low iron	(58)	GMPR
Ferromanganese, standard (briquettes)	(58)	138
Ferromanganese, standard (high carbon)	(58)	138
Ferromolybdenum	(58)	GMPR
Ferronickel chrome iron scrap	(57)	8
Ferronickel iron scrap	(57)	8
Ferrophosphorus	(58)	GMPR
Ferrosilicon	(58)	GMPR
Ferrosilicon briquettes	(58)	GMPR
Ferrotungsten	(58)	GMPR
Ferrovanadium	(58)	GMPR

Production Records are being made *with*



H-W *improved* METALKASE LININGS

The durability of H-W Improved Metalkase linings

in electric steel furnaces is reflected in the increased tonnages being produced in the many plants where they are established. Since operating conditions unavoidably vary widely from plant to plant, comparisons of tonnages may be quite misleading. However, a report has just been received from one plant giving a total of 639 heats and a production of 20,409 tons of steel with a furnace having a 9-inch lining of H-W Improved Metalkase. It further states that there was no necessity whatsoever for patching during the furnace campaign.

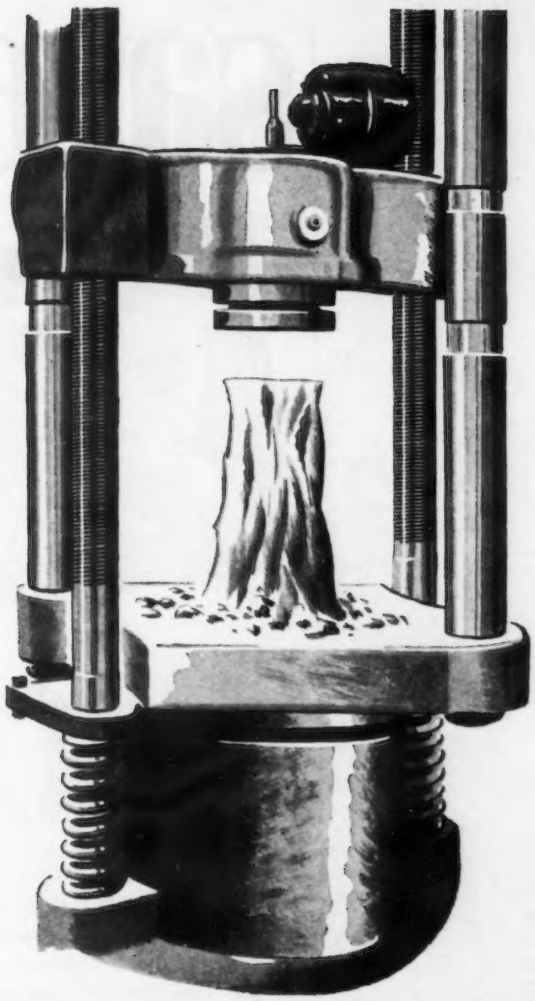
We confidently believe that a comparison of H-W Improved Metalkase brick with other types of refractories in like service will definitely demonstrate their superiority.

H-W MAGNAMIX • **A Magnesite Ramming Mixture for Basic Furnace Bottoms** • **Easy to Install** • **Economical** • **Durable**

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES • WORLD'S LARGEST PRODUCER OF REFRACTORIES • GENERAL OFFICES, PITTSBURGH, PENNA.

Commodity or Service	OPA Div.	Price Reg. No.
Fluorspar	(59)	126
Foil: aluminum, copper, composition, lead, and tin	(56)	GMPR
Forgings, aluminum-alloy	(56)	GMPR
Forgings: brass, bronze, and copper	(56)	GMPR
Fuller's earth	(59)	327
Gallium	(59)	GMPR
Gasket metal, lead	(56)	GMPR
German silver scrap	(57)	8
Germanium	(59)	GMPR
Gilding metal-clad steel scrap	(57)	Exempt
Gilsonite	(59)	327
Gold bullion	(55)	GMPR
Gold ores and concentrates	(55)	Exempt
Gold, semi-fabricated (except dental gold)	(55)	GMPR
Granules, roofing	(59)	327
Graphite	(59)	327
Graphite products (except for electrical uses): crucibles, stoppers, retorts, etc.	(56)	GMPR
Greensand	(59)	327
Grinding wheels, abrasive (except rubber)	(56)	316
High-alloy special steel scrap	(58)	GMPR
High speed tool steel scrap	(58)	GMPR
Hot work die steel scrap	(58)	GMPR
Iceland spar (calcite)	(59)	327
Ilmenite	(59)	327
Impression lead	(56)	GMPR
Indium	(55)	GMPR
Iridium metal, waste, or products (except jewelry)	(55)	309
Kaolin	(59)	327
Kieselguhr	(59)	327
Kyanite	(59)	327
Lead bullet or ammunition rod and wire	(56)	199
Lead bullion	(55)	Exempt
Lead, crawlproof sheet	(56)	GMPR
Lead, flashing sheet	(56)	GMPR
Lead ingots, linked ingots, and billets	(55)	69
Lead, metallic	(55)	69
Lead, net or seine	(56)	GMPR
Lead ores and concentrates	(55)	Exempt
Lead pipe and sheet (antimonial, chemical, tellurium, and tellurium antimonial)	(56)	GMPR
Lead pipe, tin-lined	(56)	GMPR
Lead powder	(56)	GMPR
Lead, primary (except antimonial lead)	(55)	69
Lead, residues of	(57)	Exempt
Lead scrap	(57)	70
Lead, secondary	(57)	70
Lead shot: dropshot and buckshot	(56)	GMPR
Lead wire (welding wire)	(56)	GMPR
Lithium compounds (except lithium salts)	(55)	GMPR
Lithium metal	(55)	GMPR
Magnesium ingots and alloy ingots, primary	(55)	314
Magnesium mill and fabricated products	(56)	GMPR
Magnesium powder	(55)	GMPR
Magnesium remelt (secondary) ingots	(55)	302
Magnesium scrap	(55)	302
Manganese boron	(58)	GMPR
Manganese bronze ingots	(57)	202
Manganese metal: carbon reduced, electrolytic	(58)	GMPR
Manganese ore, battery (domestic)	(58)	Exempt
Manganese ore, battery (imported)	(58)	248
Manganese ore, chemical (domestic)	(58)	Exempt
Manganese ore, chemical (imported)	(58)	248
Manganese ore, metallurgical	(58)	248
Masurium	(59)	GMPR
Mercury	(55)	93
Mesothorium	(59)	GMPR
Meta-bentonite	(59)	GMPR
Mica	(59)	GMPR
Molybdenum metal	(58)	GMPR
Molybdenum ores and concentrates	(58)	Exempt
Molybdenum oxide	(58)	GMPR
Molybdenum oxide briquettes	(58)	GMPR
Molybdenum silicide	(58)	GMPR
Molybdenum special alloys	(58)	GMPR
Molybdenum trioxide	(58)	GMPR
Molybdic acid	(58)	GMPR
Monazite	(59)	GMPR
Monel metal, primary	(57)	GMPR
Monel metal, secondary: ingot, scrap, shot	(57	8
Nickel alloys, primary	(57)	GMPR
Nickel alloys, secondary	(57)	8
Nickel, primary	(57)	GMPR
Nickel scrap: pure, monel metal, stainless steel, nickel steel, and other scrap materials containing nickel	(57)	8
Nickel silver ingots	(57)	202



THE "BLOCK BUSTER" MACHINE

and what Hele-Shaw Fluid Power had to do with it—

Not so long ago, machines for breaking test blocks of concrete, wood and other materials were essentially weighing devices, mechanically operated.

Someone conceived the idea of using hydraulic rams for exerting the tremendous pull or push required. The first rams were pumped by hand, but during the natural course of improvement, our engineers were approached for suggestions. They recommended a Hele-Shaw Pump and controls.

Several important advantages were gained. The Hele-Shaw Pump, being a rotary radial piston type, applied the power smoothly and continuously. Through comparatively simple controls, the rate of flow of the oil under pressure could be regulated to obtain quickly any desired rate of travel of the ram . . . and automatically maintain it.

With the oil fluid medium, the pump could be located at any convenient point, not necessarily on the testing machine. The test load could be read directly from hydraulic gauges.

Many types of hydraulic testing machines are now powered by the fluid muscles of Hele-Shaw Pumps. Possibly you, too, have a profitable application for Hele-Shaw Fluid Power in your post-war planning. If you *think* so, put your product or process, machine operation or control up to Hele-Shaw engineers.

THE **Hele-Shaw** *Fluid Power Pump*

Æ CO 75th ANNIVERSARY

OTHER A-E-CO PRODUCTS: TAYLOR STOKERS, MARINE DECK AUXILIARIES, LO-HED HOISTS

AMERICAN ENGINEERING COMPANY

2410 ARAMINGO AVENUE • PHILADELPHIA, PA.

NEWS OF INDUSTRY

Commodity or Service	*OPA Div.*	*Price Reg. No.*
Olivine	(59)	327
Osmium metal, waste, or products (except jewelry)	(55)	309
Palladium metal, waste, or products (except jewelry)	(55)	309
Pewter, lead (sheets)	(56)	GMPR
Pipe, copper and copper alloy	(56)	GMPR
Plates: aluminum, copper, and copper alloy	(56)	GMPR
Platinum metal, waste, or products (except jewelry)	(55)	309
Pumice	(59)	327
Pumicite	(59)	327
Quartz crystal products (oscillators, resonators, filters, etc.)	(56)	GMPR
Quartz crystals	(59)	GMPR
Quartz pebbles	(59)	327
Radium	(59)	GMPR
Rails: brass, bronze	(56)	GMPR
Rhodium metal, waste, or products (except jewelry)	(55)	309
Rivets, aluminum	(56)	GMPR
Rods: aluminum, copper, and copper alloy	(56)	GMPR
Rolls, copper and copper alloy	(56)	GMPR
Sheets: aluminum, copper, copper alloy	(56)	GMPR
Sil-x briquettes	(58)	GMPR
Silcaz alloy	(58)	GMPR
Silico-spiegeleisen	(58)	GMPR
Silicomanganese	(58)	GMPR
Silicomanganese briquettes	(58)	GMPR
Silicon bronze ingots	(57)	202
Silicon carbide	(59)	GMPR
Silicon metal	(58)	GMPR
Sillimanite	(59)	327
Silvaz alloy	(58)	GMPR
Silver bullion (domestic)	(55)	GMPR
Silver bullion (imported)	(55)	198
Silver scrap	(55)	GMPR
Silver, semi-fabricated: alloys, wire, sheet, blanks, circles, solders, brazing alloys, silver-clad metals, silver inlays, etc.	(55)	GMPR
Silver solder (other than brazing solder)	(56)	GMPR
Simanal	(58)	GMPR
Sinkers, lead	(56)	GMPR
SMZ alloy	(58)	GMPR
Sodium molybdate	(58)	GMPR
Sodium tungstate	(58)	GMPR
Solder: pig, bar, and wire	(56)	GMPR
Solder, residues of	(57)	Exempt
Spacer blocks, lead	(56)	GMPR
Spiegeleisen	(58)	GMPR
Stainless steel scrap	(57)	8
Stampings, nonferrous	(56)	GMPR
Strontianite	(59)	327
Tantalite	(59)	GMPR
Tantalum	(59)	GMPR
Tape, lead	(56)	GMPR
Tellurium	(59)	GMPR
Terne metal	(56)	GMPR
Thallium metal	(59)	GMPR
Thorium metal	(59)	GMPR
Tin ores and concentrates	(55)	Exempt
Tin oxide	(55)	GMPR
Tin, primary: pig and special shapes	(55)	17
Tin, residues of	(57)	Exempt
Tin, secondary	(57)	GMPR
Tin: sheet, pipe, bar, extruded products, pulverized, and tape	(56)	GMPR
Titanium metal and alloys	(59)	GMPR
Tools, diamond: core bits, dies (0.002 in. and larger), dressing tools, shaped tools, wheels, etc.	(56)	GMPR
Tripoli	(59)	327
Tubes, collapsible: lead, tin	(56)	GMPR

NEWS OF INDUSTRY

Commodity or Service	*OPA Div.*	*Price Reg. No.*
Tubing and piping, aluminum	(56)	GMPR
Tubing, copper and copper alloy (new)	(56)	GMPR
Tubing, copper and copper alloy (scrap)	(57)	20
Tubing, lead	(56)	GMPR
Tungsten carbide powder	(58)	GMPR
Tungsten metal powder	(58)	GMPR
Tungsten ores and concentrates	(58)	Exempt
Tungstic acid	(58)	GMPR
Type metals (electrotype, linotype, monotype, stereotype)	(56)	GMPR
Type metals, residues of	(57)	Exempt
Uranium metal	(59)	GMPR
Vanadium metal	(58)	GMPR
Vanadium ores and concentrates	(58)	Exempt
Vanadium oxide, red or black cake	(58)	GMPR
Vanadium special alloys	(58)	GMPR
Vermiculite	(59)	327
Welding wire, lead	(56)	GMPR
Witherite	(59)	327
Zinc anodes and special shapes	(55)	GMPR
Zinc base alloys: primary, secondary	(57)	GMPR
Zinc die cast scrap	(57)	3
Zinc dust	(56)	GMPR
Zinc, metallic	(55)	81
Zinc ores and concentrates.	(55)	Exempt
Zinc oxide	(55)	166
Zinc, primary slab	(55)	81
Zinc, residues of	(57)	Exempt
Zinc rolled products (sheet, strip, plate, etc.)	(56)	124
Zinc scrap	(57)	3
Zircon	(59)	GMPR
Zirconium	(59)	GMPR
Zirconium ferro-alloys	(59)	GMPR
Zirconium oxide, oxychloride, etc.	(59)	GMPR

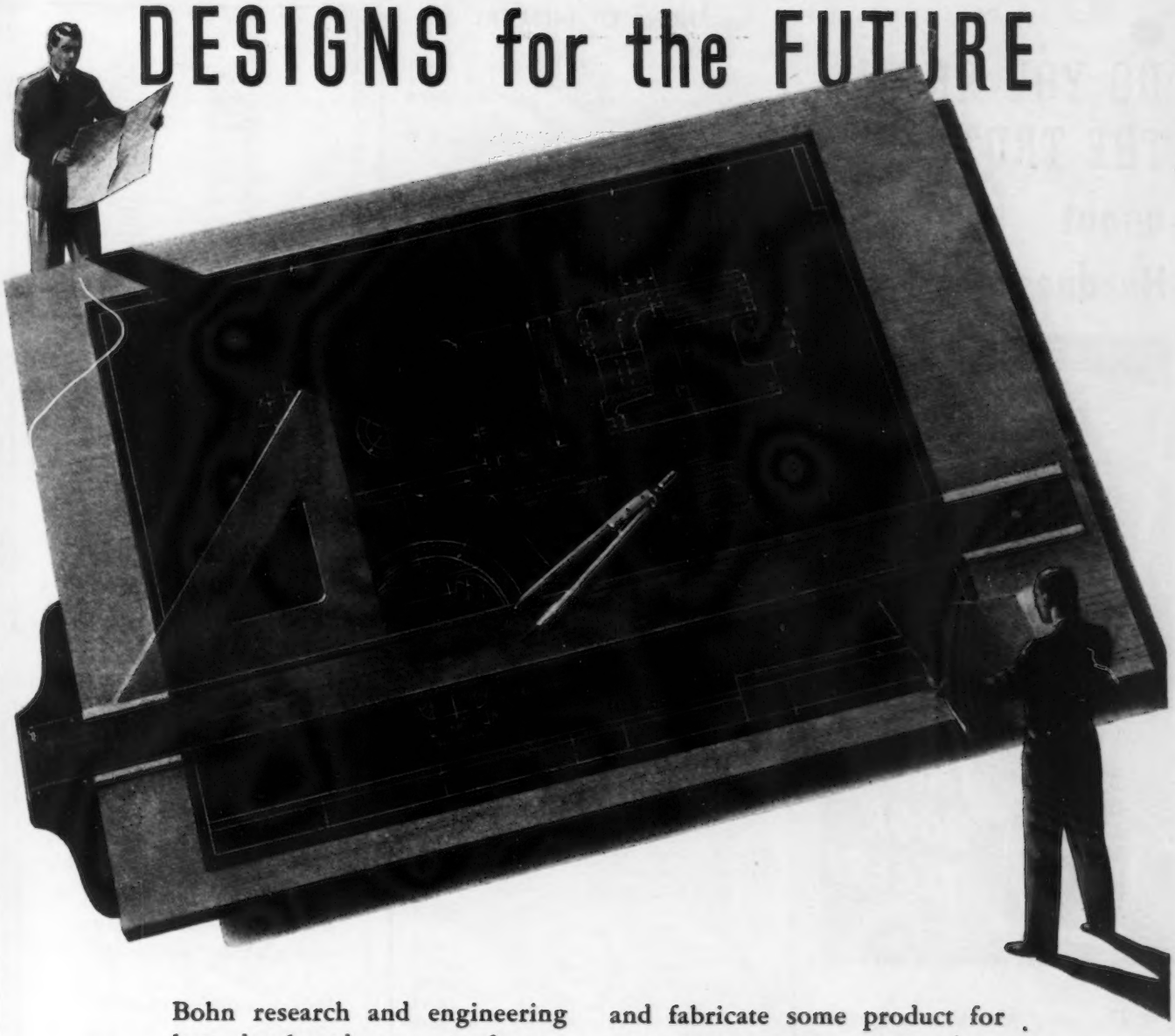
IRON AND STEEL PRICES

Industrial Materials Price Division
Iron and Steel Price Branch

Commodity or Service	*OPA Div.*	*Price Reg. No.*
Armor plate, rolled or forged	(62)(65)	6, 49
Axles (railroad), rolled or forged	(62)(65)	6, 49
Baling bands, steel	(62)(65)	6, 49
Barrels, steel (new)	(64)	GMPR
Barrels, steel (used)	(66)	43
Bars, concrete reinforcing (fabricated)	(64)	159
Bars, concrete reinforcing (unfabricated)	(62)(65)	6, 49
Bars, iron or steel (cold-rolled, hot-rolled): merchant, muck, tool steel, splice, etc.	(62)(65)	6, 49
Belting, wire	(62)(65)	6, 49
Billets: iron, steel	(62)(65)	6, 49
Black plate	(62)(65)	6, 49
Blooms: iron, steel	(62)(65)	6, 49
Bolts (except aluminum)	(64)(66)	147, GMPR
Boxes, sheet steel	(64)	GMPR
Brads	(62)(65)	6, 49
Buckets, steel (new)	(64)	GMPR
Buckets, steel (used)	(66)	43
Cable and wire, steel (uninsulated)	(62)(65)	6, 49
Cans, general line (new)	(64)	GMPR
Cans, packers': tin, terne, or black plate (new)	(64)	GMPR
Cans, tin: under size 10 and larger (used)	(66)	GMPR
Cans, tin: under size 10 (used)	(66)	Exempt

Commodity or Service	OPA Div.	Price Reg. No.
Caps and tops, bottle: metal	(64)	GMPR
Casing, oil well (new)	(62)(65)	6, 49
Casing, oil well (used)	(66)	230
Castings, gray iron	(63)	244
Castings, high alloy steel	(63)	214
Castings, low alloy steel	(63)	41
Castings, malleable iron	(63)	241
Castings, manganese steel	(63)	235
Closures, metal	(64)	GMPR
Coke, beehive (except Pennsylvania blast furnace)	(60)	121, 122
Coke, beehive (Pennsylvania): blast furnace	(60)	77
Coke, by-product (except foundry and blast furnace)	(60)	121, 122
Coke, by-product: foundry and blast furnace	(60)	29
Concrete reinforcing bars, wire, spirals, welded stirrups, and rods (fabricated)	(64)	159
Concrete reinforcing bars, wire, and rods (unfabricated)	(62)(65)	6, 49
Conduit, rigid steel—manufacturer level	(62)	6, 49
Containers, steel: shipping (new)	(64)	GMPR
Containers, steel: shipping (used)	(66)	43
Cords, wire: special (aircraft, etc.)	(62)(65)	6, 49
Cylinders, high-pressure gas: steel (new)	(64)	GMPR
Cylinders, high-pressure gas: steel (used)	(66)	GMPR
Drums, steel (new)	(64)	GMPR
Drums, steel (used)	(66)	43
Fencing, wire: woven, chain-link, lawn, etc.	(62)(65)	6, 49
Forgings, ferrous (axles, wheels, and armor plate only)	(62)	6
Galvanized bands, hoops, pipes, plates, sheets, and strips	(62)(65)	6, 49, 230
Gas, manufactured	(60)	GMPR
Guards, wire	(64)	GMPR
Hoops, steel	(62)(65)	6, 49
Ingots, iron and steel	(62)(65)	6, 49
Iron ore (except Lake Superior District)	(60)	Exempt
Iron ore, Lake Superior District (produced in Minn., Wis., and Mich.)	(60)	113
Iron, pig	(60)	10
Iron scrap	(61)	4
Kegs, metal (new)	(64)	GMPR
Kegs, metal (used, 14 gal. or more capacity)	(66)	43
Kegs, metal (used, under 14 gal. capacity)	(66)	GMPR
Manganese steel castings and manganese steel castings products	(63)	235
Merchant wire products (bale ties, wire fencing, barbed wire, poultry netting, fence posts, etc.)	(62)(65)	6, 49
Milk shipping containers	(64)	GMPR
Muck bars	(62)(65)	6, 49
Nails, cut	(64)	GMPR
Nails, wire	(62)(65)	6, 49
Nuts and bolts (except aluminum)	(64)(66)	147, GMPR
Oil country tubular goods (new)	(62)(65)	6, 49
Oil country tubular goods (used)	(66)	230
Pails, steel (new)	(64)	GMPR
Pails, steel (used)	(66)	43
Partitions and grille work, wire	(64)	GMPR
Pig iron	(60)	10
Piling, iron and steel (new)	(62)(65)	6, 49
Piling, iron and steel (used)	(66)	49
Pipe and tubing, iron and steel: except cast-iron (new)	(62)(65)	6, 49
Pipe and tubing, iron and steel: except cast-iron and chrome-nickel stainless steel (used)	(66)	230
Plates and sheets, iron and steel: fabricated (new)	(64)	GMPR
Plates and sheets, iron and steel: unfabricated (new)	(62)(65)	6, 49
Plates and sheets, iron and steel (used)	(64)	310
Rail joints and fastenings (new)	(62)(65)	6, 49
Rail joints and fastenings (used)	(66)	49
Railroad specialties: side frames, bolsters, yokes, and couplers	(63)	41
Rails, iron and steel (new)	(62)	6
Rails, iron and steel: relaying and relaying girder	(66)	46

DESIGNS for the FUTURE



Bohn research and engineering have developed many non-ferrous improvements. Each one of these steps is of far-reaching importance to industrial America.

Business leaders more and more consult this organization because of our advanced knowledge and wide experience. Maybe some day, Bohn engineers can design and fabricate some product for you. Today all of our efforts are on war materials.

But later, let's talk to each other about how we might be of assistance to your company. We make it our business to find new ways to produce better things for less money.

BOHN ALUMINUM AND BRASS CORPORATION
GENERAL OFFICES—LAFAYETTE BUILDING • DETROIT, MICHIGAN
Designers and Fabricators
ALUMINUM • MAGNESIUM • BRASS • AIRCRAFT-TYPE BEARINGS

Know the Name

BOHN

Commodity or Service	*OPA Div.*	*Price Reg. No.*
Rivets (except aluminum)	(64)	147, GMPR
Rods, iron and steel: tie, wire, etc.	(62)(65)	6, 49
Roofing, iron and steel: flat, corrugated V-crimped (galvanized or painted)	(62)(65)	6, 49
Rounds: tube, forging	(62)(65)	6, 49
Screws and screw spikes (except aluminum)	(64)	147, GMPR
Shafting, steel (used)	(64)	310
Shapes, steel (fabricated)	(64)	GMPR
Shapes, steel (unfabricated)	(62)(65)	6, 49
Shapes, structural (new)	(62)(65)	6, 49
Shapes, structural (used)	(64)	310
Sheet bars	(62)(65)	6, 49
Sheet piling and accessories, plain	(62)(65)	6, 49
Sheets and strips, iron and steel (all types)	(62)(65)	6, 49
Shipping containers, steel (new)	(64)	GMPR
Shipping containers, steel (used)	(66)	43
Siding, iron and steel (all types)	(62)(65)	6, 49
Skelp	(62)(65)	6, 49
Slabs: iron, steel	(62)(65)	6, 49
Spikes: wire, track	(62)(65)	6, 49
Staples	(62)(65)	6, 49
Steel scrap (except gilding metal-clad steel, high alloy chrome steel, hot work die steel, high speed tool steel)	(61)	4
Strapping, iron and steel (fabricated)	(64)	GMPR
Strapping, iron and steel (unfabricated)	(62)(65)	6, 49
Strips, iron and steel	(62)(65)	6, 49
Structural steel shapes and plates (used)	(64)	310
Structural steel shapes, fabricated (new)	(64)	GMPR
Structural steel shapes, unfabricated (new)	(62)(65)	6, 49
Tacks (except map and thumb tacks)	(64)	GMPR
Terne plate	(62)(65)	6, 49
Ties, cotton bale	(62)(65)	6, 49
Ties: iron, steel (mill run)	(62)(65)	6, 49
Tin plate	(62)(65)	6, 49
Toggle bolts	(64)	GMPR
Tool steel bars: rolled, forged	(62)(65)	6, 49
Track bolts and nuts (except aluminum)	(64)(66)	147, GMPR
Track materials: tie plates, angle and joint bars, etc. (new)	(62)(65)	6, 49
Track materials: tie plates, angle and joint bars, etc. (used)	(66)	49
Tubing, mechanical and pressure (new)	(62)(65)	6, 49
Tubing, mechanical and pressure (used)	(66)	230
Turnbuckles	(64)	GMPR
Washers, ferrous	(64)	GMPR
Wheels, car: rolled or forged	(62)(65)	6, 49
Wire cloth and netting, ferrous (except industrial cloth)	(62)(65)	6, 49
Wire fabrics, concrete reinforcing: welded or woven (unfabricated)	(62)(65)	6, 49
Wire, ferrous (except insulated)	(62)(65)	6, 49
Wire rope and cable assemblies	(64)	GMPR
Wire rope and strand, uninsulated	(62)(65)	6, 49

MACHINERY

Industrial Manufacturing Price Division
Machinery Price Branch

Commodity or Service	*OPA Div.*	*Price Reg. No.*
Agricultural machinery and equipment (except hand tools)	(38)	133, 216
Air-conditioning equipment (25-h.p. or 25-ton and over)	(39)	136
Air tools	(37)	134, 136
Atomizers: air, gas, water	(39)	136
Automobile parts	(43)	136
Ballast machines (cleaners, spreaders, diskers)	(39)	136
Batchers (construction equipment)	(37)	134, 136
Bearings (except babbitted, friction, nonferrous, rubber, automotive, and railroad truck side): antifriction, ball, roller, etc.	(42)	136
Belt tighteners and shifters, power transmission	(42)	136
Belting, industrial: leather, chain (except proof chain or coil chain, fabric, wire, or rubber)	(42)	136
Bending machines (metalworking)	(40)	1, 67
Blowers, exhausters, and air-moving equipment (except free-air fans and farm machinery)	(39)	136
Blowers, soot: industrial, marine	(39)	136
Boilers: industrial, marine	(39)	134, 136
Bonds, rail	(44)	136
Bookbinders' machines	(39)	136
Boring mills	(40)	1, 67
Boxes, electrical: cutout, floor, outlet, switch, etc.	(41)	136
Brake equipment, railroad: lining, shoes, etc.	(44)	136
Brakes and brake parts, motor vehicle	(43)	136
Brick and tile-making machines	(39)	136
Bronzing and dusting machines (for the printing trade)	(39)	136
Brushes and contacts, electric	(41)	136
Buckets: clamshell, bottom dump, etc.	(37)	134, 136
Buggies	(38)	133
Bulldozers	(37)	134, 136
Burners, coal stoker — 1,200 pounds per hour capacity and over	(39)	136
Burners, gas: industrial	(39)	136
Burners, oil: industrial and marine (for No. 6 oil and heavier)	(39)	136
Bushings and bushing material (plastic and composition bushings and bushings sold as screw machine products)	(42)	136
Cable accessories	(41)	82, 136
Cable, insulated	(41)	82, 136
Cable protecting sleeves	(41)	136
Cages, mine-shaft	(37)	134, 136
Calipers, machinists'	(39)	136
Carlines, roof: steel	(44)	136
Cars and car equipment: railroad, rapid transit, street (freight or passenger)	(44)	136

Commodity or Service	OPA Div.	Price Reg. No.
Cars, industrial	(39)	136
Cars, mining	(37)	134, 136
Casters, industrial	(42)	136
Chains, power transmission: roller, silent, drive, and sprocket	(42) (43)	136
Chemical process machinery	(39)	136
Chippers	(37)	134, 136
Chutes, concrete	(37)	134, 136
Classifiers, mining	(37)	134, 136
Clay-working machinery	(39)	136
Clockwork systems, industrial (for mechanical instruments)	(42)	136
Clutch facings, except rubber	(42)	136
Clutches, except motor vehicle	(42)	136
Clutches, motor vehicle	(43)	136
Coilers, spring	(40)	1, 67
Coilers, strip steel	(39)	136
Coils, electric	(41)	136
Communication equipment (including telephone, telegraph, and signaling apparatus and public address systems)	(41)	136
Compressors, air or gas	(39)	136
Concentrating machinery (mining equipment)	(37)	134, 136
Conditioning and humidifying machines for industrial processing	(39)	136
Conduit and fittings, electrical (except rigid steel conduit)	(41)	136
Conduit, rigid steel — distributor level	(41)	136
Construction machinery and equipment	(37)	134, 136
Containers, steel: freight car	(44)	136
Conversion equipment, electric	(41)	136
Converters, rotary	(37)	134
Conveyors and conveying systems (except mining or farming)	(39)	136
Conveyors, mining	(37)	136
Copper wire and cable: new, used	(41)	82, 136
Cordage and rope machines	(39)	136
Cores, valve	(42)	136
Cork-working machinery	(39)	136
Cranes and attachments	(37)	134, 136
Crushing and mixing machinery for ore, coal, stone, slag, etc.	(37)	134, 136
Cutting machines, cloth	(39)	136
Cutting machines, paper	(39)	136
Cutting-off machines (metalworking)	(40)	1, 67
Cylinders, power: pneumatic, hydraulic, hydro-pneumatic	(39)	136
Derricks	(37)	134, 136
Die-casting machines	(39)	136
Dies: forming, stamping (except diamond dies)	(42)	136
Distillery machinery: mixers, filters, etc.	(39)	136
Ditchers	(37)	134, 136
Dollies, industrial	(39)	136
Doors, mine	(37)	136
Dovetailing machines	(39)	136
Dragline excavators	(37)	134, 136
Drags, road	(37)	134, 136
Dredging machines	(37)	134, 136
Drill presses (machine tools)	(40)	1, 67
Drilling machines (metalworking)	(40)	1, 67
Drilling tools (for gas, oil, or water wells)	(37)	134, 136
Drills: portable, wagon	(37)	134, 136
Drives, belt, cable, chain, gear, rope, sprocket	(42)	136
Drop forgings	(42)	136
Ducts, electrical: metallic, nonmetallic	(41)	136
Dust-collecting equipment	(39)	136
Dynamos, electric	(41)	136
Electrical industrial apparatus, instruments, machinery, and supplies (except locomotives)	(41)	136
Electrodes, coated	(41)	136
Electroplating and hot-dip metal-coating equipment	(39)	136
Elevators and elevator equipment, except farm	(39)	136
Engines: Diesel, gasoline, internal-combustion, kerosene, steam, semi-Diesel (except aircraft, aircraft tank, or motor vehicle)	(39)	136
Escalators, passenger	(39)	136
Excavators: cable, clamshell, crane, derrick, dragline, power shovel, etc.	(37)	134, 136
Extruding machines and equipment (metalworking)	(40)	1, 67
Farm machinery and equipment, including parts and attachments (except hand tools)	(38)	133, 246
Filing machines (metalworking)	(40)	1, 67
Filters and strainers, industrial	(39) (42)	136
Finishing machines: concrete, bituminous material	(37)	134, 136

HEAVY DUTY
BUT EASY TO OPERATE
because of
"AUTOMATIC" POWER STEER

TRADE **AUTOMATIC** MARK

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This heavy duty "AUTOMATIC" can be equipped with forks, rams, or gooseneck crane attachment to fully meet heavy duty handling needs. It affords greatest flexibility whether for multi-stacking, loading, shipping or transportation in yard or plant. You get speed—efficiency regardless of load, and full safety for the operator.

Center control for unobstructed operating visibility—compact design with accessibility to all parts—low center of gravity for safety and easy steering through our POWER STEER feature. Ask an AUTOMATIC representative.

MANUFACTURERS FOR OVER 35 YEARS *Electric Propelled* INDUSTRIAL TRUCKS

AUTOMATIC TRANSPORTATION CO.

DIV. OF THE YALE & TOWNE MFG. CO.

75 WEST 87th STREET CHICAGO, ILLINOIS

Commodity or Service	OPA Div.	Price Reg. No.
Flotation machinery (mining)	(37)	136
Fluorescent lamps, industrial	(41)	136
Forging machines (metalworking)	(40)	1, 67
Forgings, ferrous (as sold by forge shops): machined, rough	(42)	136
Formers, metal	(40)	1, 67
Foundry machinery and equipment, except fluxes	(39)	136
Furnace fans and blowers	(39)	136
Furnaces, electric	(39)	136
Furnaces, industrial (except blast and open hearth)	(39)	136
Fuse blocks	(41)	136
Gaskets (except automotive or rubber)	(42)	136, GMPR
Gages: oil pressure, water temperature, steam, air, water, etc.	(39)	136
Gear-cutting machines	(40)	1, 67
Gears, motor vehicle	(43)	136
Gears, power-transmission (except motor vehicle)	(42)	136
Generating apparatus and parts, electric	(41)	136
Generating apparatus and parts, gas	(39)	136
Generators, motor vehicle	(43)	136
Governors, gas	(39)	136
Governors, turbine: hydraulic	(42)	136
Graphite products and metal graphite products for electrical uses	(41)	136
Grinding machines (metalworking)	(42)	1, 67
Hammer mills (crushing machines), except farm	(37) (39)	136
Hammers: drop, pile, jack	(37)	134, 136
Hammers, power (forging machinery)	(40)	1, 67
Hardware, pole-line	(41)	136
Headstocks, lathe (metalworking	(40)	1, 67
Heat exchange equipment, industrial	(39)	136
Heaters, water circulation	(39)	136
Heating units and devices, electric: industrial	(41)	136
Hoists: power-driven, chain (steam, air, electric)	(37)	134, 136
Honing machines	(40)	1, 67
Hose and tubing, metallic: flexible (subassemblies only)	(42)	136
Humidifying and conditioning machines for industrial processing	(39)	136
Humidifying equipment for air conditioning (25-ton and over)	(39)	136
Indicators, mechanical	(39)	136
Injectors, fuel (except airplane)	(39)	136
Instruments, electrical: controlling, indicating, measuring, etc. (except for surgical, dental, optical, and automotive use)	(41)	136
Instruments, mechanical: measuring, controlling, testing, recording, indicating, etc. (except carpenters' tools; or for surgical, optical, and dental use)	(39)	136
Instruments, surveying, drafting, engineering (except school, art or office supplies)	(39)	136
Jacks, power-driven: hydraulic, screw, ratchet, track, trench	(37) (44)	134, 136
Jigs and fixtures	(42)	136
Journal bearing trimming machines	(40)	1, 67
Keyseating machines	(40)	1, 67
Laboratory testing and scientific instruments	(39)	136
Lamp-making machinery (for incandescent bulbs)	(39)	136
Lamps, arc (other than motion picture photographic)	(41)	136
Lamps, fluorescent: industrial	(41)	136
Lamps, portable: for industrial and marine purposes	(41)	136
Lapping machines (metalworking)	(40)	1, 67
Lathe tools (standard extras)	(40)	1, 67
Lathes (metalworking)	(40)	1, 67
Lathes (woodworking)	(39)	136
Leatherworking machinery	(39)	136
Lighting plants, electric	(37) (41)	134, 136
Loaders: belt, bucket, front end	(37)	134, 136
Loading equipment, freight car	(44)	136
Loading machines: coal, ore, rock	(37)	134, 136
Locomotive parts (draft controls, blow down and blow off systems and fittings, cab, curtains, boosters, etc.)	(44)	136

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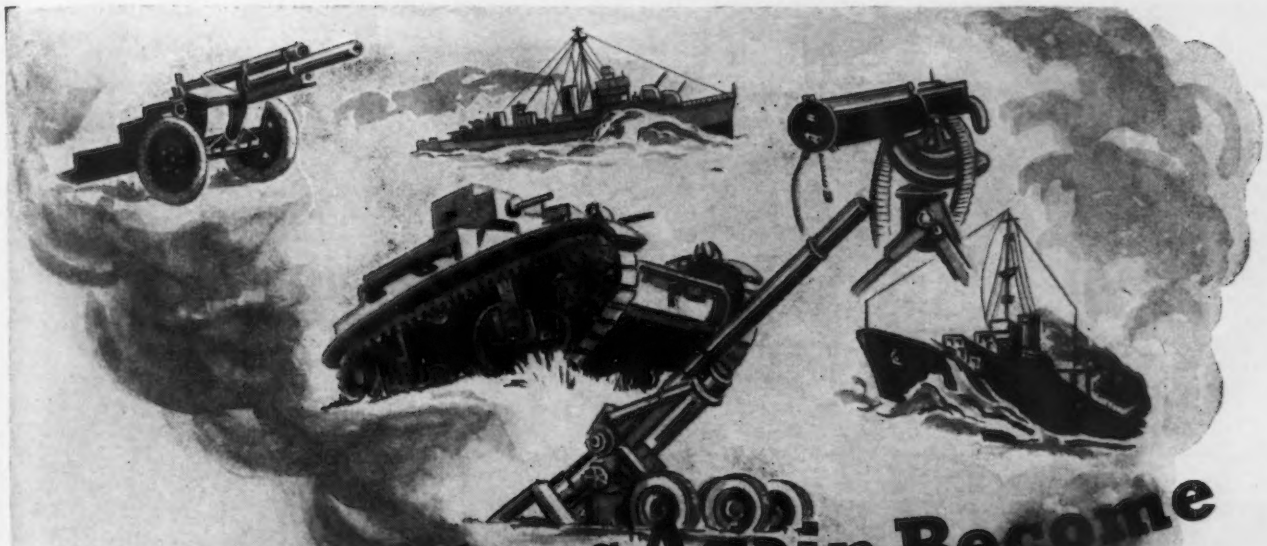
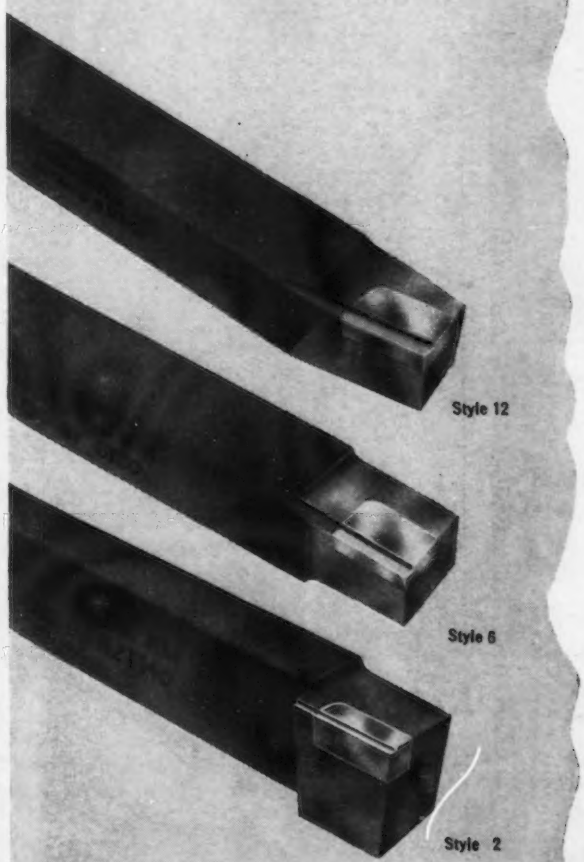
Commodity or Service	OPA Div.	Price Reg. No.
Locomotives: railroad, mining, industrial (steam, electric, Diesel, or Diesel-electric)	(44)	136
Lubricating systems and devices, industrial	(39)	136
Lubricating systems and parts, motor vehicle	(43)	136
Machine tools	(40)	1, 67
Machine tools — rental, repair, rebuilding	(40)	136
Machinery services (contract repairing, rebuilding, testing, etc., of machines)	(42)	136
Magnetos, electric	(41)	136
Magnets, electric	(41)	136
Marine engines (except portable outboard motors)	(39)	136
Marking machines, metal	(39)	136
Materials handling equipment, industrial: cars, trucks, racks, etc.	(39)	136
Measuring instruments and machines, electrical	(41)	136
Measuring instruments, mechanical	(39)	136
Metallic hose and tubing, flexible (subassemblies only)	(42)	136
Metals and alloys, special (except steel with less than 6% alloy content): for electrical resistance, magnetic, or glass-sealing purposes	(41)	136
Micrometers	(39)	136
Milling machines (metalworking)	(40)	1, 67
Mining machinery and equipment (except hand tools)	(37)	134, 136
Mixers: concrete, bituminous materials, ore, sand, etc. (stationary, portable)	(37)	134, 136
Molds, industrial (except of rubber)	(42)	136
Motor-generator sets, electric	(41)	136
Motors, electric	(41)	136
Mowers, railway track	(44)	136
Nail-heading machines	(39)	136
Numbering machines, metal	(39)	136
Oil field machinery and tools	(37)	134, 136
Oil-well drilling equipment repair service	(37)	136
Oilers, hydraulic pressure and pump	(39)	136
Ore-crushing and concentrating machinery	(37)	134, 136
Ovens, industrial: bakers', etc.	(39)	136
Packing (except automotive or rubber)	(42)	136, GMPR
Packing house machinery	(39)	136
Paint-making machinery	(39)	136
Panel and distribution boards	(41)	136
Patterns (except paper)	(42)	136
Petroleum refinery equipment and machinery: heat exchangers, vapor phase cracking process condensers, tubes, stills, etc.	(39)	136
Pinions	(42)	136
Pipe layers	(37)	134, 136
Pistons and piston rings (except motor vehicle and railroad)	(42)	136
Pistons and piston rings, motor vehicle	(43)	136
Pistons and piston rings, railroad	(44)	136
Planers (metalworking)	(40)	1, 67
Planers, surfacers, and jointers (woodworking)	(39)	136
Plastic molding and fabricating of parts (contract)	(42)	136
Plastic molding machinery	(39)	136
Plastic parts, fabricated	(42)	136, GMPR
Pneumatic tools	(37)	134, 136
Pneumatic-tube conveying systems	(39)	136
Polishers (metal-working machines)	(40)	1, 67
Portable tools, power-driven	(37)	134, 136
Power and generating equipment, electrical	(41)	136
Power switchboards and parts	(41)	136
Power take-offs	(41)	136
Power-transmission machinery	(42)	136
Precision apparatus, electrical	(41)	136
Precision measuring tools	(39)	136
Presses, hydraulic (metalworking)	(40)	1, 67
Pressure vessels	(39)	136
Pulleys, industrial power-transmission	(42)	136
Pulp-mill machinery	(39)	136
Pulverizers	(37)(38)(39)	133, 134, 136, 246
Pump jacks	(37)	136
Pump liners, centrifugally cast	(42)	136
Pumps (except automotive, hand-operated, and farm pumps)	(37)(39)	134, 136
Punches, power	(40)	1, 67
Rail grinding, cutting, and sawing machines: portable	(37)	134, 136
Rail laying machines	(44)	136
Railroad equipment (railroad, rapid transit, street, subway): locomotives and parts, cars and parts, electric motors and control equipment, forged switches, track appliances, etc.	(44)	136
Refrigeration machinery and equipment	(39)	136
Relays, electrical	(41)	136
Riveters, portable	(37)	136
Riveting machines, stationary	(40)	1, 67
Road-building machinery	(37)	134, 136
Rods, connecting	(42)(44)	136
Rods for electrical uses: hot-rolled black or cleaned	(41)	82, 136
Rolling-mill machinery	(39)	136
Sandblasting equipment	(37)(39)	134, 136
Scales, weighing: industrial, platform	(37)(44)	134, 136
Scarfing machines	(40)	1, 67
Scarifiers	(37)	134, 136
Screw machine products (except bolts, nuts, screws, and rivets)	(42)	136, GMPR
Screw machines	(40)	1, 67
Shafts, flexible	(42)	136
Shafts, power-transmission	(42)	136
Shapers (metalworking machines)	(40)	1, 67
Shapers (woodworking machines)	(39)	136
Shears, power	(40)	1, 67
Sheaves, power-transmission	(37)(42)	134, 136
Sheet-metal working machines	(40)	1, 67
Shifters, belt	(42)	136
Shovels, power (including attachments)	(37)	134, 136
Signaling devices, motorr vehicle	(43)	136
Slitters, metal	(39)	136
Slotters (metalworking machines)	(40)	1, 67
Speed drives, variable	(42)	136
Speed reducers	(42)	136
Speedometers, industrial	(39)	136



When Guns Again Become *Plowshares*



During wartime, production costs become secondary to production volume — natural and industrial resources available for war production have become the bases for our economy, and the ability to increase production has become the measure of proportional value.

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Commodity or Service	OPA Div.	Price Reg. No.
Springs for mechanical instruments and industrial machinery	(42)	136
Sprockets and sprocket chains	(42)	136
Stampings, ferrous	(42)	136
Starters and starter parts, motor vehicle	(43)	136
Steam shovels	(37)	134, 136
Steel-rolling machines	(39)	136
Stokers, industrial and marine (1,200 pounds or more per hour)	(39)	136
Stokers, locomotive	(44)	136
Stopers, mine	(37)	134, 136
Swaging machines (metal-working)	(40)	1, 67
Switchboard apparatus	(41)	.136
Switches, electric: automatic, enclosed, knife, snap, time, etc.	(41)	136
Switches, forged; railroad	(44)	136
Switchgear and switchgear accessories	(41)	136
Tanks and vessels, open (except field-erected, domestic fuel oil storage, and plumbing fixture tanks; cans; etc.)	(39)	136
Tanks, pressure: metal (except field-erected tanks; high-pressure cylinders of 1,000 pounds or less water capacity for shipping or storing liquids or gases at pressures under 3,000 pounds per square inch; range boilers or expansion tanks not over 192 gal. capacity of not over 12 BWG metal)	(39)	136
Tapping machines (metal-working)	(40)	1, 67
Testing machines (for measuring abrasion, shearing strength, tensile strength, torsion, etc.)	(39)	136
Thermometers, industrial	(39)	136
Threading machines (metal-working)	(40)	1, 67
Tires, steel: car, locomotive	(44)	136
Tools, hand: special (for manufacture, repair, or maintenance of aircraft and military equipment)	(42)	136
Tools, portable (power-driven)	(37)	134, 136
Track appliances, railroad	(44)	136
Tractors, agricultural	(38)	133, 246
Tractors (except agricultural and railroad)	(37)	134, 136
Tractors, railroad	(44)	136
Trailers: passenger car, truck—new and used	(43)	GMPR
Transformers, electric (including specialty transformers)	(41)	136
Transmission equipment, mechanical power (except automotive)	(42)	136
Truck tractors	(43)	GMPR
Truck trailers	(43)	GMPR
Trucks, farm	(38)	133, 246
Trucks, industrial (hand operated)	(39)	136
Turbine-generator sets	(41)	136
Turbine governors, hydraulic	(42)	136
Turbines: hydraulic, steam	(41)	136
Universal joints	(42)	136
Valves, automatic	(39)	136
Veneer-mill machines	(39)	136
Vibrators, screen	(39)	136
Warp and knot-tying machines	(39)	136
Water softening and purifying equipment, industrial	(39)	136
Welding and cutting apparatus, gas	(39)	136
Welding apparatus, electric	(41)	136
Welding rods and wire, except lead	(41)	136
Well-drilling equipment	(37)	134, 136
Wheels, motor vehicle	(43)	136
Wheels, railroad car: chilled cast iron and spun steel	(44)	136
Winches, power-driven	(37)	134, 136
Winders (textile machinery)	(39)	136
Windlasses, power-driven	(37)	134, 136
Windmill generating sets	(38)	133, 246
Windmills	(38)	133, 246
Windshield frames and wipers, motor vehicle	(43)	136
Wire, cord, or cable for conducting electricity: copper, copperclad, or copper alloy (single or multiple strand, bare or insulated)	(41)	82, 136
Wire-working machines	(39)	136
Wiring devices, electric	(41)	136
Woodworking machines: bending, boring, chucking, jointing, milling, molding, turning	(39)	136
Wool and worsted finishing machines	(39)	136

NEWS OF INDUSTRY

Drum Users Told Correct Purchase Method

• • • **Users of new steel** shipping drums were advised today by the Containers Division, WPB, of the correct procedure in obtaining a preference rating which is required prior to submitting application on Form PD-835 for authorization to purchase new steel shipping containers.

Under Conservation Order M-255 (New Steel Shipping Drums), WPB allocates shipments of new steel shipping drums by manufacturers. However, a preference rating must be assigned before the Containers Division can authorize users to purchase the containers.

Users who now have a preference rating should make application for authorization to purchase new steel drums on Form PD-835.

A user not operating under CMP or PRP, who does not yet have a preference rating assigned, must first obtain such rating on Form PD-25F or Form CMP-4-b. After receiving the preference rating, he should apply for authority to purchase new steel shipping drums on Form PD-835.

A user operating under CMP or PRP, who does not yet have a preference rating assigned, must file for such rating on Form PD-1-a. Forms PD-25F or CMP-4-B should be addressed to the WPB in Washington, D. C.

Adirondack Facilities of National Lead Increased

• • • **Adirondack** production facilities of the National Lead Co., directly related to the war effort, will be materially enlarged as the result of a building and construction contract at Tahawus, New York, just awarded to the Turner Construction Co., it was announced yesterday. The facilities will be financed and owned by Defense Plant Corporation and they will be operated under lease agreement by National Lead.

Designed for the purpose of sintering the magnetite output of the recently completed neighboring titanium ore concentrating plant, in order to produce feed of a size suitable for blast furnaces, the new project will be of reinforced concrete construction and will feature a minimum use of critical materials. The principal unit of the group, which will also include storage bins and a dewatering house, will measure 308 x 64 feet with heights rising to 42 and 72 ft. Plans have been prepared by John E. Greenawalt, engineer.

U. S. Steel Shipments Show Increase for May

• • • **Shipments** of finished steel products by subsidiary companies of the United States Steel Corp., for May were 1,706,543 net tons. The May shipments compare with 1,630,828 net tons in April, an increase of 75,715 net tons. For the first five months in 1943 shipments were 8,487,353 net tons compared with 8,729,439 net tons in the comparable period of 1942, a decrease of 242,086 net tons.

Freight Reduction Drops Some Machinery Ceilings

Washington

• • • **Freight rate reductions** made effective May 15 will be reflected in reduced ceiling prices for certain formula-priced items of machinery, machinery parts, farm equipment and ferrous forgings, OPA announced recently.

Specifically, manufacturers of items covered by the action, and also sellers subject to Maximum Price Regulation 136, other than manufacturers, shall use the freight rates in effect on March 31, 1942 or current freight rates, whichever are lower.

The action was contained in several amendments, effective June 14, 1943.

Quality Carbon Steel Is Redefined by WPB

• • • **WPB last week redefined quality carbon steel as that made in hot topped molds or if made in open top molds having special surface preparation either in an intermediate or final form. Under this definition the term does not include tonnage produced by special discard only.**

Producers of quality carbon steel were also told that they could accept orders for a product in regular carbon steel if they do not receive orders for the required tonnage of quality carbon by the lead time for the product involved.

New Ore Vessels Added To Great Lakes Fleet

Detroit

• • • **Two big** ore-carrying freighters were delivered during May by the Great Lakes Engineering Works at River Rouge, Mich., the U. S. Maritime Commission announced. The vessels are 621 ft. long, making them virtually the largest operating on the Great Lakes. They are classified as single-deck bulk cargo ships with capacity in each vessel of 14,500 tons. The ships are now in service.

Restrictions Dropped On Aluminum Rivet Inventories

• • • **The nation's facilities** for producing aluminum rivets have been developed to such an extent that, temporarily, maximum capacity is greater than current consumption, WPB reported. However, with the expanding aircraft program it is expected that within a few months consumption will exceed production.

To build up a backlog of rivets against the future demand and to make full use of present facilities, the WPB has issued Inventory Direction No. 9 under CMP Regulation 2. The direction stipulates that from June 14 through Dec. 31, the inventory restrictions of the CMP Regulation shall not apply to the acceptance of deliveries of aluminum rivets acquired for use in the production of aircraft or aircraft components.

Warehouses Named to Stock Aluminum Rivets

Washington

• • • **To provide for** the needs of consumers who require aluminum rivets in amounts smaller than the minimum mill runs, the Aluminum and Magnesium division, WPB, has arranged to have stocks of these items carried by Whitehead Metal Products Co. of New York, Inc., New York; Steel Sales Corp., Chicago; Metal Goods Corp., St. Louis, Mo.; J. M. Tull Metal & Supply Co., Atlanta, Ga.; and Pacific Metals Co., Ltd., San Francisco.

The stock will include the following AN rivets in A17ST and 17ST alloy, all alumilited: 425, 426, 430, 442, 455 and 456. The diameters will be 1/16-inch, 3/32-inch, ⅛-inch, 5/32-inch, 3/16-inch and ¼-inch. Lengths will be a full range in 1/16-inch increments. The rivets will be carried in one-pound boxes and can be secured by applying the CMP allotment number to the order.


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OVERHEAD CRANES

The Annealing of Steel

(CONTINUED FROM PAGE 47)

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[5] Richard Akerman, "On Hardening Steel: Its Causes and Effects," Journ. Iron and Steel Institute, 1879, pp. 504 to 542.

[6] E. S. Davenport and E. C. Bain, "Transformation of Austenite at Constant Subcritical Temperatures," Trans. AIME, Iron and Steel Division, vol. 90, 1930, pp. 117 to 154.

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[8] Research Laboratory, U. S. Steel Corp., "The Process and Results of Austenite Transformation at Constant Temperature," Metals and Alloys, vol. 8, 1937, pp. 22 to 24.

[9] E. S. Davenport, "Isothermal Transformation in Steels," Trans. ASM, vol. 27, 1939, pp. 837 to 886.

[10] R. M. Parke and A. J. Herzig, "Hardenability of Molybdenum SAE Steels," Metals and Alloys, vol. 11, pp. 6 to 13.

[11] P. Payson, W. L. Hodapp, and J. L. Leeder, "The Spheroidizing of Steel by Isothermal Transformation," Trans. ASM, vol. 28, 1940, pp. 306 to 329.

[12] P. Payson, U. S. Patent 2,188,155, January, 1940.

[13] P. Payson, U. S. Patent 2,251,289, August, 1941.

[14] J. R. Blanchard, R. M. Parke, and A. J. Herzig, "The Effect of Molybdenum on the Isothermal Subcritical Transformation of Austenite in Low and Medium Carbon Steels," Trans. ASM, vol. 29, 1941, pp. 317 to 335.

[15] R. A. Flinn, Earnshaw Cook and J. A. Fellows, "A Quantitative Study of Austenite Transformation," Trans. ASM, vol. 31, 1943, pp. 41 to 70.

[16] P. Payson and J. L. Klein, "The Hardening of Tool Steel," Trans. ASM, vol. 31, 1943, pp. 218 to 256.

[17] J. R. Blanchard, R. M. Parke and A. J. Herzig, "The Effect of Molybdenum on the Isothermal Subcritical Transformation of Austenite in Eutectoid and Hypereutectoid Steels," ASM, preprint, October, 1942.

Editor's Note: The second of the five parts of this article will be presented next week.

Arc Welded Blast Furnace

(CONTINUED FROM PAGE 55)

welded they may be shipped knocked down.

The cost of Social Security tax varies as the shop and field labor costs. As these costs are reduced by using a welded design, the tax is reduced in proportion.

To protect the workmen and the company, insurance is carried during the erection of the structure. Since its costs are set up as a percentage of the field labor cost, it is also reduced by using a welded design.

Proportionate prices and savings for the entire unit are summarized in Table V. These unit prices include the cost of materials, drafting, shop fabrication, freight, erection, Social Security tax, insurance, general overhead and profit. In Table VI, these costs are broken down functionally.

Operational Cost Savings

A lower maintenance cost is expected for arc welded furnaces. The furnace, the gas cleaning structures, the air preheating structures, and the large piping operate under an average pressure of 30 lb. per sq. in. Butt welded joints are a more positive form of gas-tight construction than joints that must be riveted and then caulked. This is particularly important in structures subjected to a wide range of temperatures which cause considerable expansion and contraction during operation. As a blast furnace usually operates continuously for several years until it must be shut down to be relined with brick, the appurtenant structures, being arc welded, will offer additional assurance of their uninterrupted service.

At times a "hot spot" develops on the furnace shell and water is sprayed on it to prevent it from breaking out. This frequently causes the plate to buckle, necessitating a repair. It is much easier to patch or replace a plate in a shell by welding.

Newer methods and improvements of blast furnace operations require its auxiliary equipment to be removed, replaced, or revised many times during the life of the furnace. Welded structures are more adaptable to these adjustments. It is an easy matter to add on or to take out a valve or a manhole in a pipe line or to make a new pipe connection. When an entire plant layout is revised, the appurtenant equipment and piping may be salvaged to be relocated, welded together and used again.

Frequently the hot blast main and bustle pipe must be relined. Time and labor are saved in relining the smooth inside surface of the welded pipe as compared to fitting the lining brick over the rivet heads and lap joints of a riveted pipe.

These operational savings will accrue throughout the entire life of the furnace, which is about 35 years. They are conservatively estimated by blast furnace operators as amounting to 5 per cent of the initial cost of the completed structures. The cost of a complete 1000-ton blast furnace is $3,000,000. The anticipated savings is then $150,000 per furnace.

Savings to Steel Industry

The total annual gross cost savings to the steel industry in the United States by using blast furnaces of welded construction is the summation of the initial savings and the operational savings. When the recent expansion is completed, there will be about 250 blast furnaces operating in the United States. Consequently, assuming no further expansion in the near future, but merely a savings derived from replacing old furnaces, the savings based on seven (250/35) furnaces replaced per year is: $150,000/35=$4300 operational savings per furnace per year

Initial cost savings	7 x $154,000	$1,078,000
Operational cost savings	250 x $4300	1,075,000
Total cost savings per year to the steel industries in the United States		$2,153,000

But of greater importance in these turbulent times is the consideration of public safety and of the social advantages that must be obtained and retained. A cost savings may imply greater profits. But now it takes on a more significant meaning. A cost savings, by using arc welding, is an index of the material, the man hours and the production time made available for making other necessary structures and war equipment.

Arc welding is assisting the expansion of our steel production at its very nucleus—the blast furnace. It is making available more iron, to be refined into steel which will then be used to make more vital war equipment.

Smelting of Vanadium-Bearing Titaniferous Sinter

(CONTINUED FROM PAGE 59)

high in titanium apparently does not form as readily in the bosh, and the hearth slag is more viscous at the level of the iron notch. Whether these difficulties were due entirely to the large loss of heat from the crucible of the experimental furnace and to the low blast temperatures available would have to be determined by commercial furnace tests.

The tendency of the hearth of the experimental furnace to build up on high-titanium slags is attributed to the high viscosity of the slag at the prevailing temperatures. None of the copper-colored crystals of the compound usually referred to as titanium cyanonitride were found in the salamander of the furnace. This compound, which has a density less than that of pig iron, has been found in localized areas of salamanders of commercial furnaces. It does not occur as a continuous layer, but is surrounded by slag and metal. As this slag and metal would be molten at a normal hearth temperature, these isolated crystals would be liberated at the working level of the furnace bottom and would be carried from the furnace mechanically by the slag and iron.

The substitution of titaniferous sinter for iron ore has the general effect of replacing silica in the slag with titanium dioxide. Except for one period when a more basic slag was produced, the metal from the experimental furnace was high in sulfur. The production of high sulfur iron during most of the test was due partly to the presence of 0.12 per cent sulfur in the sinter. Proper adjustments in the sintering operation would eliminate most, if not all, of the sulfur in the concentrates. Production of metal averaging 0.045 per cent sulfur on the more basic high-titanium slag indicates that such a slag will desulfurize readily, provided enough bases are present and suitable temperatures are maintained.

The sinter, which was made at St. Louis, from vanadium-bearing titaniferous magnetite, contained in the as-received condition some large, dense places and some rather fine material. To provide material comparable in size to the rest of the burden, the sinter was screened through a 1.5 in. hummer screen. The oversize then was fed to a cone crusher set at 1.5 in.

The Danube ore from the Mesabi range was used in the as-received condition. It was a beneficiated ore that had passed through a 1½ x ¾ in. screen and was relatively free of very fine particles. The size of the calcite was similar to that of the sinter and iron ore, but the dolomite was available readily only in a smaller size. On the whole, the physical structure of the raw materials was well adjusted for use in the experimental furnace.

General operating data for nine experimental burdens are given in the accompanying table. As shown in the table, burdens C, C1 and C2 show a gradual increase in coke consumption from 2720 to 3600 lb. per ton of iron. The vanadium in the metal increased from 0.34 to 0.37 per cent when the first increase in coke was made, but the vanadium recovery apparently was not affected by the further increase in coke in burden C2. An increase in the titanium content of the metal from 0.15 per cent on burden C to 0.32 per cent on burden C2 also shows the effect of the increase in consumption of coke.

Except for the additional amount of flux, burden H2 was approximately the same as burden C2. Only on burden H2 did the amount of flux approach that used in normal practice on Lake ores. This increase in flux shows the effect of slag volume and basicity upon removal of sulfur, as this is the only burden that produced metal of approximately normal sulfur content.

General Operating Data

	Burden								
	A	B	C	C_1	C_2	H_2	B_2	F_2	B_2
Sinter, lb. per net ton	....	827	3,400	3,390	3,370	3,370	845	1,710	845
Iron ore	2,720	2,270	....	....	....	....	2,300	1,500	2,300
Calcite	348	345	377	405	420	320	376	284	376
Dolomite	348	276	....	....	....	760	282	228	282
Coke	3,910	2,480	2,720	3,170	3,600	3,600	3,380	3,410	3,380
Manganese ore	652	....	....	....	....	....	28	28	28
Slag	1,130	870	1,100	1,140	1,250	1,590	960	975	960

Operating Conditions

Blast temperature, deg. F.	750	824	887	914	932	950	961	892	892
Top temperature, deg. F.	520	752	797	835	765	820	849	865	748
Blast pressure, lb. per sq. in.	1.41	1.34	2.56	2.93	2.82	4.02	1.75	1.85	1.47
Air per min., cu. ft.	484	487	465	464	476	455	512	513	516
Slag temperature, deg. F.	....	2,490	2,576	2,630	2,720	2,750	2,805	2,890	2,770
Metal temperature, deg. F.	....	2,375	2,385	2,505	2,575	2,650	2,730	2,630	2,640
Tuyere temperature, deg. F.	3,045	3,150	3,035	3,075	3,055	3,090	3,125	3,160	3,135

Analysis of Products, Per Cent

Metal:									
V	....	0.09	0.34	0.37	0.37	0.38	0.14	0.20	0.12
S	0.13	0.15	0.28	0.24	0.16	0.045	0.075	0.15	0.18
Ti	0.03	0.12	0.15	0.27	0.32	0.54	0.54	0.42	0.32
Si	0.46	0.77	0.58	0.60	0.58	0.31	1.00	1.10	0.85
Slag:									
SiO_2	30.9	29.6	19.1	19.3	18.4	14.6	24.9	24.4	27.1
Al_2O_3	9.6	14.4	22.6	19.1	22.3	20.9	16.7	19.1	12.9
CaO	27.6	33.8	21.1	22.0	24.6	27.1	35.9	26.5	34.3
MgO	6.8	8.9	4.1	4.9	7.1	11.2	8.4	7.3	9.6
TiO_2	1.7	7.6	27.7	30.7	24.1	20.0	10.0	16.8	10.5
FeO	1.3	1.2	1.5	1.3	1.2	1.3	1.3	1.2	1.6
MnO	18.6	2.3	1.6	1.2	1.2	.7	1.4	1.6	1.8

PERSONALS

• **Ralph M. Hairston** and **Howard M. Thompson** have been appointed executive assistants respectively to the vice-president in charge of the Construction News Division and the vice-president in charge of Sweet's Catalog Service division, F. W. Dodge Corp., New York. Mr. Thompson became associated with the firm three years ago as Chicago manager of Home Owners Catalogs, while Mr. Hairston has been connected with the corporation since 1927.

• **Hans Lasker**, factory manager of Republic Aviation Corp., Farmingdale, N. Y., has been appointed to the newly created position of works manager. **Henry MacDonald** has been named works manager at the Evansville, Ind., manufacturing facility of the corporation.

• **Norman O. Aeby**, purchasing agent of the Johns-Manville Corp., New York, was elected president of the Purchasing Agents Association of New York at the annual meeting held recently. He succeeds Walter E. Cummin. Other officers elected are: **Millard W. Merril** and **David M. Meeker**, vice-presidents and **E. B. Fielis**, treasurer.

• **Frank E. Caldwell** has been appointed service manager of the Pump Engineering Service Corp., Cleveland. Mr. Caldwell was formerly employed by Northwest Airlines as assistant to the president.

• **Ray P. Whitman**, first vice-president of the Bell Aircraft Corp., in addition to holding this position, has been appointed manager of the Niagara Frontier division, which includes plants at the Niagara Falls airport, and in Buffalo. Vice-president and assistant general manager **Omer L. Woodson** becomes vice-president and manager of the Georgia division, embracing the activities at the Bell bomber plant at Marietta, Ga. **Charles L. Beard**, secretary and treasurer, will assume new duties as administrative assistant to Mr. Bell.

• **R. A. Devlieg**, since 1937 vice-president of the Nash-Kelvinator Corp., Kenosha, Wis., and who has been in charge of manufacturing operations in the Wisconsin plants, has been appointed vice-president in charge of all plant operations and will move his headquarters to Detroit. Before joining Nash-Kelvinator he was in charge of production for the Reo Motor Car Co.

• **H. L. Bills**, director of industrial relations for Acme Steel Co., Chicago, has been elected president of the Industrial Relations Association of Chicago. **W. K. Lunt**, director of personnel for W. F. Hall Printing Co., was chosen vice-president. For the past 20 years Mr. Bills has been active in the field of industrial relations and served with a firm of management engineers prior to his employment by Acme in 1937.

• **C. K. Swafford**, works manager and member of the board of directors of Gisholt Machine Co., Madison, Wis., has been elected a vice-president of the company. Mr. Swafford originally entered the employ of Gisholt in 1913. Shortly after the United States entered World War I he was transferred to other activities, returning to the company in 1930 as works manager, in which capacity he will also continue to serve.

• **K. L. Crickman**, manager of the Indianapolis branch of the Carpenter Steel Co., has been appointed regional manager of the Southwestern area. His headquarters will continue to be in Indianapolis. **C. H. Harton** has been named assistant branch manager of the Indianapolis territory.

• **Herbert G. Dillon** was recently appointed manager of the newly-formed mining section of the Industrial Department, Westinghouse Electric & Mfg. Co. From 1933 to 1941 he was sales engineer with the General Motors Corp. He moved from there to the Lee Norse Co., serving as sales manager until his appointment by Westinghouse as manager of the mining section.

• **E. D. Dickinson**, designing engineer of the turbine engineering division of General Electric's Lynn River works, has retired after 43 years of service with the company. At the time of his retirement, Mr. Dickinson was the oldest turbine engineer in the General Electric Co., both in age and service.

• **George W. Person**, formerly abrasive engineer in the St. Louis territory for Norton Co., Worcester, Mass., has taken a position in Chicago as manager of the Abrasive Division of Screw Machine Supply Co., one of Norton's Chicago distributors.

• **John F. Moser**, manager of the New Orleans district of the B. F. Goodrich Co. since 1930, has been appointed southeast regional manager for the company's store administration department. Named new district manager in New Orleans is **Donald E. Lagarde.**

• **K. M. Holt** has been appointed executive engineer, **A. D. Somes** has been appointed assistant engineer, and **F. C. Linn**, designing engineer of the Turbine Engineering Division, General Electric's Lynn River works. From 1916 to 1918 Mr. Holt was drafting office foreman at Lynn, going to the turbine engineering division in 1918 as assistant to the designing engineer, a position which he held until his present appointment as executive engineer.

• **J. A. Krugler**, vice-president in charge of sales of Taylor-Wharton Iron & Steel Co., New York, has been named a member of the Frog and Switch Industry Advisory Committee of the WPB.

• **Harry J. Moores**, well known engineering consultant, has been appointed manager of the newly established Baltimore office of the Alvey-Ferguson Co., Cincinnati.

• **John R. Bangs**, formerly head of the department of administrative engineering at Cornell University, has been named general manager of industrial and personnel relations of the Edward G. Budd Mfg. Co. **Robert W. Desing** will be his assistant at Budd's Hunting Park plants, and **J. B. Jones** will assist him at Budd Field. **Dr. Edwin H. McIlvain** will assume direction of an expanded industrial health and rehabilitation department for the company.

• **G. E. Merkle** has been appointed sales manager of Perfex Gage & Tool Co., Detroit. Mr. Merkle entered the automobile industry in 1916 as a factory representative of the Chevrolet Motor Co. in the Detroit area. In 1940 he became a Chrysler distributor for the entire state of Wisconsin, remaining in that capacity until joining the Perfex Co. in the newly created post of sales manager.

• **John D. Leitch** has been made chief engineer of the Electric Controller & Mfg. Co., Cleveland. Dr. Leitch has been with Electric Controller & Mfg. Co. since 1937. Prior to that he was associated with the Mechanical Engineering and Electrical Engineering departments of the Steel Co. of Canada.

• **Carl H. Vaupel** has been appointed assistant general manager of the Mount Vernon, Ohio, and Grove City, Pa., plants of the Cooper-Bessemer Corp. Mr. Vaupel was formerly Eastern sales representative for the Northern Pump Co. He joined Cooper-Bessemer in 1941 and has devoted his time to various managerial duties at the Grove City plant.

• **D. B. McCoy** has been appointed general sales manager of Steel Co. of Canada Ltd., Toronto. He will succeed George Spence who is retiring. Mr. McCoy has been with Steel Co. since 1910, and was successively sales representative for Northern Ontario, Eastern Ontario, manager of the Vancouver office, manager of the Toronto office, and later assistant general sales manager.

• **Edgar S. Hutton,** formerly with Clarke-Harrison Inc., Philadelphia, has been elected treasurer of Chambersburg Engineering Co., Chambersburg, Pa. He succeeds S. L. Peterman, Jr., who resigned recently.

• **Franklyn Waltman** has been appointed director of public relations of the Sun Oil Co. He succeeds the late Judson C. Welliver. Mr. Waltman joined the public relations department of the Sun Oil Co. in 1942.

CARL H. VAUPEL, assistant general manager, Cooper-Bessemer Corp.

• **D. A. Robison** has resigned as vice-president of Caterpillar Tractor Co., Peoria, Ill., to become the company's distributor at Salt Lake City and **Gail E. Spain,** who was recently made a vice-president will succeed him as administrative vice-president of the advertising, sales, export, engine sales, special products and war contracts departments. Mr. Robison started in the shipping room of the parts department of the Caterpillar Tractor Co. at San Leandro, Cal., in 1926. He became a vice-president in 1940. Mr. Spain joined the company in 1929 as logging representative. He was appointed general sales manager in 1940 and a vice-president in 1942.

• **John C. Sykora** has recently been appointed a vice-president of Gould Storage Battery Corp., Depew, N. Y. Mr. Sykora joined the corporation in 1919, and became sales manager in 1940. **Roy J. Stanton** has been appointed motive power sales manager. He was formerly in charge of the Detroit office.

• **Bernard R. Schneider,** formerly assistant chief engineer of Champlain Corp., is now associated with Chicago Pneumatic Tool Co. in the capacity of chief engineer.

• **H. B. Jameson** has been appointed division manager of the New England territory of the Aro Equipment Corp., Bryan, Ohio. Mr. Jameson, formerly assistant to the division manager in Philadelphia, will make his headquarters at 52 Harvard Avenue, Allston District, Boston.

OBITUARY...

• **William Browne Gillies,** vice-president in charge of operations of Youngstown Sheet & Tube Co., Youngstown, died June 20 in Youngstown Hospital after a heart attack. He was 59 years old. Mr. Gillies became associated with Youngstown Sheet & Tube in 1923, when the company acquired the Steel & Tube Co. of America at Chicago. He was district manager of operations in Chicago until October, 1929, when he went to Youngstown as assistant vice-president. In 1933, Mr. Gillies was elected vice-president in charge of operations, the position he held at the time of his death.

Mr. Gillies was president of the Youngstown Chamber of Commerce. Recently he organized a committee in Youngstown to plan the community's postwar improvements and consider postwar problems.

• **William R. Day,** president of the Day Piston Co., Cleveland, died recently. Mr. Day was 72 years of age. He had been president of the company for the past 23 years.

• **Madison T. McCarthy,** research and experimental engineer for the last two years in charge of the experimental laboratories at the Howard Foundry Co., Chicago, died on June 13th. He was well known for his research and development work in nonferrous foundry processes, and was credited with many cost saving practices in aluminum and magnesium founding. He was 55 years of age.

• **Charles E. Lindell,** president of the Lindell Drop Forge Co., Lansing, Mich., which he organized in 1923, died June 10, aged 61 years.

• **Frederick W. Hodges,** president of the Detroit Lubricator Co. until he retired in 1941 and a director of the American Radiator Co., died in Detroit, June 11.

• **G. K. Abbott,** president of the Abbott Ball Co., Hartford, Conn., died June 13 after a short illness.

• **Thomas S. Denny** of the U. S. Steel Export Co., New York, died June 6, aged 56 years. Mr. Denny spent 43 years with various U. S. Steel subsidiaries, starting with the National Steel Works in 1900.

• **Norman D. Hoke,** traffic director for the Chrysler Corp., Detroit, died recently. Mr. Hoke was with the company since its inception.

• **Luke U. Milward,** president of Electro Refractories & Alloys Corp., Lackawanna, N. Y., died June 10 in Buffalo after a short illness. Before organizing Electro Refractories & Alloys, Mr. Milward was Buffalo district sales manager for the Anchor Packing Co., Pittsburgh. He was 55 years old.

• **Frank M. Andrew,** former secretary of the Andrews Steel Co., died at his home in Ft. Thomas, Ky., last week. Mr. Andrew had been active with the business for many years and was secretary until Andrews sold their interest in the steel company a few weeks ago.

MACHINE TOOLS

. . . News and Market Activities

Draft Losses Not Being Refilled

Cincinnati

• • • **Flow of new orders** into the machine tool market has definitely eased and the tendency in the market is to "roll with the punch." Many plants at the present time indicate that as the draft or some other reason causes an employee to leave, they are not always making replacements, so that as new business shrinks and production catches up with order books, the manpower supply in the plants will also shrink correspondingly. While this is not general throughout the industry, it has become the established practice in a number of plants. The large machine tool plants still continue to have a heavy backlog and in these quarters they are continuing to look for more employees whenever reasonably good men can be found. Here and there machinery builders have taken over the manufacture of other articles than machine tools to fill out their full production schedule where they have caught up with necessary operations in some departments on present machine tool orders.

•

Mild Boom Reported In New Fill-In Tool Orders

Cleveland

• • • **Machine tool builders** are experiencing a rather unusual but very mild boom in new orders. The heaviest buyers on the market now, of course, are prime and sub-contractors working on aircraft, but discounting these machine orders there is another phase of buying, quite transitional but none the less welcome. Dealers and builders indicate that quite a volume of orders are incoming, consisting mainly of fill-in stuff. None of the orders are of any great size, but in the aggregate are appreciable.

This has resulted from only one cause. In the hastily expanded industries throughout the country, the main volume of machine tools were ordered, making up the original boom in machine tool construction. However, in planning such expansions, many of the smaller items were overlooked and it is these things that are being bought today. Orders are reported coming in thick and fast, and, while such items will not swamp builders with work, they do afford the builders a chance to more conveniently taper off their work.

Surprisingly good deliveries are quoted on such items as buffing machines, grinders, drill presses, and other small pieces of equipment. Likewise, many of the cutting tool, gage, drill and reamer manufacturers are offering quick deliveries. It was stated by one dealer that standard gages, such as snap and thread gages, are being sold off-the-shelf, while special gage deliveries are exceedingly quick. In the main, 75 per cent of the deliveries quoted today are good with the chief hold-ups occurring on such items as chucks and collets, where there is still a critical situation in so far as supply is concerned.

•

GEORGE W. TURNER, soon to be 66, who has rounded out over 30 years employment with the Lodge & Shipley Machine Tool Co., Cincinnati, was the recipient of a distinguished service pin honoring his long employment. As a skilled "lay-off" man, the veteran worker is performing the same kind of job in this war as he did back in 1917 when he also helped produce vital machine tools for the allied efforts. With one son in the Army Air Force, he is determined to do his best on the home front.

Brown & Sharpe Reports 1942 Net Earnings

• • • **After a $5,300,000 provision** for renegotiation of war contracts, $1,000,000 for contingencies, and $10,626,449 for income and excess profits taxes, the Brown & Sharpe Mfg. Co., Providence, in 1942, showed a net income of $2,226,756, equal to $16.06 a share. The net income for 1941, when taxes amounted to $9,704,117, was $4,385,640 or $31.64 a share.

•

Farms Provide Outlet For Post-War Production

Chicago

• • • **A suggestion** of the possibilities of the farm market as a customer of the metal industry in the postwar years is contained in a tabulation showing the average age of farm implements published in the June issue of the *Agricultural Outlook*.

This tabulation, published below, indicates that with favorable prices for farm products the farm market can provide a substantial outlet for mechanical equipment after the war.

Tractor Drawn or Mounted	Number on Farms Jan. 1, 1943— Thousands	Aver. Age of Machines on Jan. 1, 1942— Years
Tractors	1,906	6.4
Disk plows	173	8
Oneway disks	163	7
Disk harrows	1,228	8
Mowers	345	5
Grain drills	422	9
Grain binders	356	9
Combines, all sizes	296	5
Windrow pickup balers	31	4
Cornpickers	140	6
Row crop cultivators	987	5
Row crop planters	216	6
Row crop binders	83	8
Horse Drawn		
Riding moldboard plows	1,001	17
Disk harrows	1,294	16
Row crop cultivators, walking, 1 horse	3,891	13
Row crop cultivators, riding	2,298	15
Row crop planters, over 1 horse	1,684	16
Row crop binders	511	17
Mowers	2,504	15
Sulky or dumprakes	2,148	17
Side delivery rakes	720	11
Grain drills	1,264	18
Grain binders	986	19
Hay balers, stationary	58	19
Miscellaneous		
Stationary power balers	59	13
Grain threshers	160	16
Cream separators	1,748	10
Milk machines	310	8

For Sharper, Higher Capacity Separation of *NON-FERROUS SCRAP* the Dings ***DOUBLE DRUM*** Separator

IN many plants separating aluminum and other non-ferrous machine shop scrap, the Dings double drum separator is proving of great value in effecting cleaner separations of increased tonnages. This is one of a complete line of Dings drum type separators including agitating drums for separating badly entangled scrap. Write for Catalog 660 giving full details, capacities, etc.

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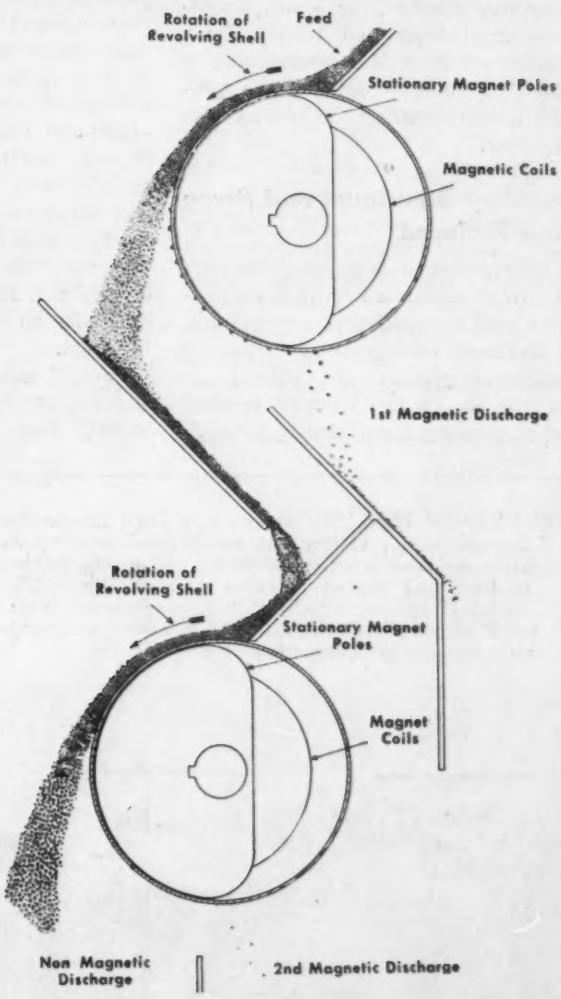

Above—diagrammatic illustration of operating principle of Dings double drum separator.

Dings MAGNETIC SEPARATION HIGH INTENSITY

NON-FERROUS METALS

. . . News and Market Activities

Dow Ludington Plant Begins Operations

Ludington, Mich.

• • • **Dow Magnesium Corp.** has put its Ludington plant into operation, manufacturing magnesium chloride which will be shipped to the recently opened Marysville, Mich., unit for final fabrication into magnesium.

Completion of the Ludington plant raises Dow's total output to 35 times its 1939 production.

The plant includes lime kilns for burning dolomite rock, a power plant, carbonator plant, filter plant, evaporation crystallizer and driers. Dock facilities on Pere Marquette Lake, a branch of Lake Michigan, are provided, accommodating the largest lake freighters.

•

Secondary Aluminum and Scrap Prices Reduced

• • • **To assist in continuing the normal** flow of aluminum scrap from producers and accumulators to smelters, the maximum base price of secondary aluminum ingot has been reduced one cent per lb, to the 14-cent present level of primary aluminum "pig" with which it recently has had to compete disadvantageously.

This action is taken in conjunction with and to aid WPB program, which has experienced difficulty in allocating secondary aluminum ingot under abnormal wartime market conditions. OPA's action also will tend to restore the normal pre-war relationship between primary and secondary aluminum ingot.

Maximum Price Regulation No. 2 (aluminum scrap and secondary aluminum ingot), issued June 17, 1943, and superseding revised Price Schedule No. 2, as amended, in general reduces both scrap and secondary ingot maximum prices 1c. a lb. below the ceiling previously established. In certain cases where changes in previous relationships were deemed necessary to improve the "flow" of ingot or scrap, the reduction amounts to only ½c. a lb. This is the case, for example, on segregated borings and turnings.

Several new quality classifications also are established by the new regulation. Some of these are intended to make sure that certain high-grade varieties of scrap go back to the primary producer either as scrap or as secondary ingot, thus keeping them from becoming mixed with lower grade scrap.

•

Aircraft Aluminum Products Control Group Setup

• • • **The appointment of an** Aircraft Aluminum Products Control Committee, charged with responsibility for increased production of essential aluminum forms and their equitable distribution among aircraft manufacturers has been announced by C. E. Wilson.

Appointment of the committee is an outgrowth of the meeting held last month in Dayton, Ohio, attended by approximately 100 representatives of the aluminum and aircraft industries, the Army, Navy and WPB.

Chairman of the new committee is Arthur H. Bunker, director of WPB's Aluminum and Magnesium Division. Other members are Harold Boeschenstein, WPB; Brigadier General F. M. Hopkins, Army; Captain Don Rice, Navy; T. B. Wright, director, Aircraft Resources Control Office; Frank Russell, National Aircraft War Production Council. Hugh Wilder, representing the Aluminum Co. of America, will be on call for committee meetings.

Particular attention will be paid by the committee to the needs of the greatly accelerated production of heavy bombers, already far ahead of the goal for this date as laid down two years ago by President Roosevelt.

Further integration of the work of the Aluminum Division and the Aircraft Scheduling Unit at Wright Field, Dayton, will be effected when the forgings section of the division is moved on July 1 from WPB's regional office in Cleveland to ASU headquarters at the field.

United States production of combat, transport and trainer aircraft during May reached the unprecedented figure of nearly 7,200 planes of all types, with a total air-frame weight of approximately 60 million pounds. Output will be substantially larger in June, with the production curve continuing its steady rise thereafter until it meets the maximum of available supplies of the aluminum, copper and alloy steel required to turn out finished planes.

MAGNESIUM MAKER: At the new Dow Magnesium Corp., plant at Ludington, Mich., visitors at the formal opening June 15 saw these lime kilns, looking toward the firing end where dolomite limestone is burned to lime and slaked to form milk of lime. The lime is utilized in a chemical process which takes brine pumped from wells in the Ludington area and separates out the 10 per cent proportion of magnesium chloride for use in fabrication of magnesium.

Refiner, Smelter Quotations

(Cents per lb.)

Copper, electrolytic, Conn. Valley	12.00
Copper, electrolytic, New York	11.75
Copper, Lake	12.00
Tin, Straits, New York	52.00
Zinc, East St. Louis	8.25
Zinc, New York	8.67
Lead, St. Louis	6.35
Lead, New York	6.50
Aluminum, virgin 99+%, delivered	15.00
Nickel, electrolytic, base refinery	35.00
Magnesium, 99.9+%, carlots	21.50
Magnesium, 12-in. sticks, carlots	30.00
Cadmium, delivered	90.00

ALUMINUM, No. 12 foundry grade (No. 2), 13.50c. per lb.; steel deoxidizing grades, 12.50c. to 13.75c. per lb. ANTIMONY, Asiatic, New York, nominal; American, 14.50c. a lb., f.o.b. Laredo, Tex., smelter. MERCURY, $191 to $193 per 76-lb. flask, f.o.b. shipping point or port of entry. BRASS INGOTS, commercial 85-5-5-5 (No. 115), 12.25c. a lb. COBALT, 97 to 99 per cent, $2.11 per lb. BERYLLIUM COPPER, 3.75 to 4.25 per cent Be., $15 per lb. contained Be. GOLD, U. S. Treasury, $35 an oz. INDIUM, 99.5 per cent, $10 per troy oz. IRIDIUM, $165 per troy oz. PALLADIUM, $24 per troy oz. PLATINUM, $35 per oz. SILVER, open market, New York, 44.75c. per oz. ARSENIC, prime, white, 99 per cent, 4c. per lb.

Copper, Copper Base Alloys

(Mill base prices)

Sheet: Copper, 20.87c.; high brass, 19.48c.; low brass, 80 per cent, 20.15c.; red brass, 85 per cent, 20.36c.; commercial bronze, 90 per cent, 21.07c., 95 per cent, 21.28c.; manganese bronze, 28.00c.; muntz metal, 22.75c.; naval brass, 24.50c.; phosphor bronze, grades A, B, 5 per cent, 36.25c.; Everdur, Herculoy, Olympic or equivalent, 26.00c.; nickel silver, 5 per cent, 26.50c.

Rods: Copper, hot rolled, 17.37c.; drawn, 18.37c.; free cutting brass, 15.01c.; low brass, 80 per cent, 20.40c.; red brass, 85 per cent, 20.61c.; commercial bronze, 90 per cent, 21.32c., 95 per cent, 21.53c.; Muntz metal, 18.87c.; naval brass, 19.12c.; phosphor bronze, grades A, B, 5 per cent, 36.50c.; Everdur, Herculoy, Olympic or equivalent, 25.50c.; nickel silver, 5 per cent, 28.75c.

Extruded Shapes: Copper, 20.87c.; architectural bronze, 19.12c.; manganese bronze, 24.00c.; Muntz metal, 20.12c.; naval brass, 20.37c.

ALUMINUM

Tubing: 2 in. O.D. x 0.065 in. wall: 2S, 40c. per lb. (½H); 52S, 61c. (O); 24S, 67½c. (T).

Plate: 0.250 in. and heavier: 2S and 3S, 21.2c. per lb.; 52S, 24.2c.; 61S, 22.8c.; 24S, 24.2c.

Flat Sheet: 0.188 in. thickness: 2S and 3S, 22.7c. a lb.; 52S, 26.2c.; 61S, 24.7c.; 24S, 26.7c.

2000-lb. base price for tubing; 30,000-lb. base price for plate, flat stock. Variations from the above gage, size, temper, finish and quantity require extras.

Extruded Shapes: "As extruded" temper; 2000-lb. base price. 2S and 3S, factor No. 1 to 4, 25.5c. per lb.; 14S, factor No. 1 to 4, 35c.; 17S, factor No. 1 to 4, 31c.; 24S, factor No. 1 to 4, 34c.; 53S, factor No. 1 to 4, 28c.; 61S, factor No. 1 to 4, 28½c.

The factor is determined by dividing perimeter of shape by the weight per lineal foot. All prices above are subject to factor number range, temper, length, dimensional tolerances and quantity extras.

Wire, Rod and Bar: Base price; 17ST and 11ST-3, screw machine stock. Rounds: ¼ in., 28½c. per lb.; ½ in., 26c.; 1 in., 24½c.; 2 in., 23c. Hexagonals: ¼ in., 34½c. per lb.; ½ in., 28½c.; 1 in., 25½c.; 2 in., 25½c. 2S, as fabricated, random or standard lengths, ¼ in., 24c. per lb.; ½ in., 25c.; 1 in., 24c.; 2 in., 23c. 24ST, rectangles and squares, random or standard lengths. 0.093-0.187 in. thick by 1.001-2.000 in. wide, 33c. per lb.; 0.751-1.500 in. thick by 2.001-4.000 in. wide, 29c.; 1.501-2.000 in. thick by 4.001-6.000 in. wide, 27½c.

Variation from the above size, temper, finish and quantity require extras.

MAGNESIUM

Sheet, rod, tubes, bars and extruded shapes are subject to individual quotation. Magnesium Metal Turnings: 100 lb. or more, 46c. a lb.; 25 to 90 lb., 56c.; less than 25 lb., 66c. a lb.

NON-FERROUS SCRAP METAL QUOTATIONS

Copper, Copper Base Alloy

(Current OPA maximum prices, cents per lb., f.o.b. point of shipment, plus premiums for quantities and special preparation.)

Group 1

No. 1 wire, No. 1 heavy copper	9.75
No. 1 tinned copper wire, No. 1 tinned heavy copper	9.75
No. 2 wire, mixed heavy copper	8.75
Copper tuyeres	8.75
Light copper	7.75
Copper borings	9.75
Lead covered copper wire, cable	6.00*
Lead covered telephone, power cable	6.04
Insulated copper	5.10*

Group 2

Bell metal	15.50
High grade bronze gears	13.25
High grade bronze solids	11.50*
Low lead bronze borings	11.50*
Babbitt lined brass bushings	13.00
High lead bronze solids	10.00*
High lead bronze borings	10.00*
Red trolley wheels	10.75
Tinny (phosphor bronze) borings	10.50
Tinny (phosphor bronze) solids	10.50
Copper-nickel solids and borings	9.25
Bronze paper mill wire cloth	9.50
Aluminum bronze solids	9.00
Soft red brass (No. 1 composition)	9.00
Soft red brass borings (No. 1)	9.00
Gilding metal turnings	8.50
Unlined standard red car boxes	8.25
Lined standard red car boxes	7.75
Cocks and faucets	7.75
Mixed brass screens	7.75
Red brass breakage	7.50
Old nickel silver solids, borings	6.25
Copper lead solids, borings	6.25
Yellow brass castings	6.25

Group 3

Yellow brass soft sheet clippings	8.625
Yellow rod brass turnings	8.375
Zincy bronze borings	8.00
Zincy bronze solids	8.00
Fired rifle shells	8.25
Brass pipe	8.00
Old rolled brass	7.75
Admiralty condenser tubes	8.00
Muntz metal condenser tubes	7.50
Plated brass sheet, pipe reflectors	7.50
Manganese bronze solids	7.25[1] 6.25[2]
Manganese bronze borings	6.50[1] 5.50[2]

Group 4

Automobile radiators	7.00

Group 5

Refinery brass	5.00*

*Price varies with analysis. [1] Lead content 0.00 to 0.40 per cent. [2] Lead content 0.41 to 1.00 per cent.

Aluminum

(Current OPA maximum prices, cents per lb., for less than 1000 lb. lots, f.o.b. point of shipment, plus premiums for quantities and special preparation.)

Plant scrap, segregated

2S solids	9.00
All other solids	8.50
Borings and turnings	....
Wrought alloys (17S, 18S, 32S, 52S)	7.50
High grade alloys	7.00
Low grade alloys	6.50

Plant scrap, mixed

All solids	7.50
Borings and turnings	5.50

Obsolete scrap

Pure cable	9.00
Old sheet and utensils	7.50
Old castings and forgings	8.00
Pistons, free of struts	8.00
Pistons, with struts	6.00
Old alloy sheet	7.00

For lots of 1000 to 19,999 lb., add 1c. to above prices except for old castings and forgings, pistons free of struts, pistons with struts and old alloy sheet for which there is a premium of ½c. a lb. For lots over 19,999 lb. add 1½c. a lb. to prices listed.

Magnesium

Segregated plant scrap

Pure solids and all other solids, exempt	
Borings and turnings	8.00

Mixed, contaminated plant scrap

Grade 1 solids	11.00
Grade 1 borings and turnings	7.00
Grade 2 solids	9.00
Grade 2 borings and turnings	5.00

For lots over 1499 lb. add 1c. per lb.

Zinc

(Current OPA maximum prices, cents per lb., f.o.b., shipping point.)

New zinc clippings, trimmings	7.25
Engravers', lithographers' plates	7.25
Old zinc scrap	5.75
Unsweated zinc dross	5.80
Die cast slab	5.80
New die cast scrap	4.95
Radiator grilles, old and new	4.95
Old die cast scrap	4.50

Lead

Soft and hard lead, including cable lead, f.o.b. point of shipment, deduct 0.55c. per lb. from basing point prices for refined metal.

Nickel

Nickel content 98 + per cent, copper under ½ per cent, 26c. per lb.; 90 to 98 per cent nickel, 26c. per lb. contained Ni.

ELECTROPLATING ANODES AND CHEMICALS

Anodes

(Cents per lb., f.o.b. shipping point)

Copper: Cast, elliptical, 15 in. and longer	25⅜
Electrolytic, full size, 22⅞c., cut to size	30⅛
Rolled, oval, straight, 15 in. and longer	23¼
Curved	24¼
Brass: Cast, 82-20, elliptical, 15 in. and longer	23⅝
Zinc: Cast, 99.99, 16 in. and over	16¼
Nickel: 99% plus, cast	47
Rolled, depolarized	48
Silver: Rolled, 999 fine per Troy (1-9) oz., per oz.	58

Chemicals

(Cents per lb., for quantities, based on delivery from New York City)

Copper cyanide, tech., 100-lb. bbls.	34
Copper sulphate, 99.5 crystals, bbls. 1-5	5.65
Nickel salts, single, 425-lb. bbls.	13–13.5
Silver cyanide, 100 oz. lots	40.82–41⅛
Sodium cyanide, 96% dom., 100-lb. dms.	0.15
Zinc cyanide, 100-lb. dms.	33
Zinc sulphate, 89% crystals, bbls.	6.8

SCRAP

. . . News and Market Activities

Freshening Market for Scrap Expected

• • • **With a coal strike** of unknown length confronting the steel industry, the scrap trade can look forward to a freshening in demand for both open hearth and blast furnace grades. Blast furnace scrap, which melts faster than ore and takes less coke is certain to be in demand if the coal stoppage only lasts a few days and the banking of more blast furnaces, a sure result of the first week of coal stoppage, will pick up the demand for melting scrap caused by a hot metal shortage.

Cut backs and expiration of some government contracts are seen as reducing the flow of industrial scrap somewhat and some observers are again emphasizing the threat of more stringent conditions this Fall. Despite this dire warning the Bureau of Mines survey of consumers', suppliers' and producers' stocks showed an increase of one per cent at the end of April, a figure which has now probably been lowered somewhat due to the scrap drain caused by the coal strikes. District reports likewise do not reflect very satisfactory collections which are required to build substantial stocks.

A short article on identifying steel scrap appears on p. 68 of this issue.

Members of the steel industry are again being organized to bring in remote scrap. By acting as district chiefs various steel men will expedite utilization of remote accumulations, according to R. W. Wolcott, chairman of the scrap committee of the American Iron and Steel Institute.

Reaction in Pittsburgh is a little bit unfavorable on the ceiling prices set for cinder, scale, and pit scrap by RPS 4. The ceiling prices do not reflect actual prices which had been paid. Cinder was selling for $2 and up and the new ceiling was made $4 a ton, f.o.b. Scale was selling at from $5 to $9.50 a ton but the ceiling was made $12. Pit scrap had been selling for around $16 a ton and the ceiling was made $18.

Even though these are ceiling prices, they have a way of becoming minimum as well as maximum.

Just as auto wreckers said they would go out of business if they had to sell parts as scrap last year when the government insisted on this, many wreckers are now saying they will have to go out of business if they are forced by M-311 to keep auto parts and cannot sell them as scrap.

This latest restriction has tightened up cast scrap since motor blocks are not available. The government's action in making these restrictions stems from the serious and possibly dangerous shortage in automobile parts throughout industrial areas. It is not believed likely that the government will change its position.

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Allocation Plan For Steel Scrap Announced

Washington

• • • **Given approval by WPB** Chairman Donald M. Nelson in a letter to the Attorney General, a plan for WPB allocation of iron and steel scrap to assure its movement to points of consumption and to avoid large accumulations in collection areas was announced last week by Steel Division Director H. G. Batcheller. It provides for the cooperation of scrap-consuming steel mills in the purchase of old material. Because of this a "certificate of clearance" was required from Mr. Nelson. This certificate, issued under the "Small Business Act" (Public Law 603) passed by Congress last year, grants immunity from anti-prosecution. The plan follows:

One industry representative in each scrap consuming district will be named by the consumer mills in the area to act as a point of contact in expediting the movement of any scrap which WPB may request to have moved to consuming mills in that district.

When any accumulation of scrap fails to move in the normal way the Salvage Division will inform the Steel Division and request action to move that scrap accumulation.

The Steel Division will thereupon decide to what consuming area the scrap should move, will communicate with the industry representative in that consuming area, and will request such industry representative to consult with consumers in that area and give their recommendation on how the particular accumulation of remote scrap should be allocated among consumers in that area.

Upon receipt of such advice the Steel Division will review the proposed division among consumers in the consuming area, and, after consultation with the industry representative for the consuming area, will make any changes in the division of the scrap that may appear necessary and will issue allocation orders to move the scrap to the individual consumers. Each consumer will take the srap allocated to him at the applicable OPA ceiling price.

•

CLEVELAND—While scrap supplies in the area are at present comfortable, mills are not turning down offers. The allocation of scrap that would normally supply Ohio mills into the Buffalo area for Bethlehem's Lackawanna plant is a load that scrap sources must bear in addition to normal consumption in the district. About the only types of scrap that are greater than demand are some grades of high premium scrap and stainless steel turnings. The low alloy turning supply is extremely scarce, but an easing of this situation is expected in some quarters before the end of the summer.

•

ST. LOUIS—Current scrap receipts continue to decline, due to effects of floods, hot weather, and more particularly acute manpower shortage. Mills report that since June 1 arrivals have fallen about 30 per cent under current consumption, necessitating draft on reserves to that extent. Generally about three weeks' supply is on hand, and apprehension is felt relative to the immediate and future requirements. Foundry situation is somewhat better than that of open-hearth operators.

•

PITTSBURGH—Scrap conditions are a little tighter owing to heavier scrap charges. This is occasioned by less steel making iron being available due to repairs and coal strikes.

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CINCINNATI — The market in this area is definitely dull. While mills continue to take scrap offered with few rejections reported, foundries continue to avoid taking more than they feel is necessary for present operations. Flow of material into the market is definitely impeded, with estimates of the reduction ranging from 15 to 20 per cent below the volume of last year.

•

PHILADELPHIA — Scrap is moving slowly into the mills that have lifted all but quantity restrictions. It is thought by some brokers here that there will be a lift in the movement of foundry grades some time soon.

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BIRMINGHAM—As it has been for months, the scrap market here remains extremely dull. Brokers are having difficulty in finding steel scrap for limited demands and while cast grades are relatively plentiful, demand for this type of material does not exist.

•

BOSTON—General descriptions of business by both yards and brokers is "quiet." However, tonnages of certain materials go forward regularly, particularly heavy melting and No. 2 steel, turnings, borings and bundled material. No pinch is seen in consumer yard stocks. New England mills continued to get shipyard scrap in fairly good size lots.

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BUFFALO—The scrap supply situation improved this week with the arrival of the first fleet of barges bringing iron from the seaboard via the state canal. Five barges carrying around 3000 tons of scrap unloaded at a local consumer's dock. A cargo of 5000 to 6000 tons of scrap castings also has arrived from upper lake ports for delivery to Buffalo area foundries.

•

CHICAGO—The supply picture is unchanged here with shipments into consumption just slightly in excess of actual use. However, trade authorities are warning against complacency and are stressing the need for a further increase in shipments if stockpiles for the Winter are to be built up to adequate size.

IRON AND STEEL (OTHER THAN RAILROAD) SCRAP

(All Prices Are Per Gross Ton)

	BASIC OPEN HEARTH GRADES		BLAST FURNACE GRADES				ELECTRIC FURNACE, ACID OPEN HEARTH AND FOUNDRY GRADES										
							Low Phos.		Heavy Structural and Plate			Foundry Steel					
	No. 1 & 2 Hvy. Melt. No. 1 Cp. Blk. Shts. No. 1 & 2 Bundles No. 1 Busheling	Unbaled* Machine Shop Turnings	Mixed Borings and Turnings	Cast Iron Borings	Shovelling Turnings	No. 2 Busheling	Billet, Bloom, Forge Crops	Bar Crops, Punchings Plate Scrap and Cast Steel	3 ft. and Under	2 ft. and Under	1 ft. and Under	2 ft. and Under	1 ft. and Under	Auto. Springs, and Crankshafts	Alloy Free Low Phos. and Sulphur Turnings	Heavy Axle and Forge Turn. First Cut	Electric Furnace Bundles
Pittsburgh, Brackenridge, Butler, Monessen, Midland, Johnstown, Sharon, Canton, Steubenville, Warren, Youngstown, Weirton	$20.00	$15.00	$15.00	$16.00	$17.00	$17.50	$25.00	$22.50	$21.50	$22.00	$22.50	$21.50	$22.00	$21.00	$18.00	$19.50	$21.00
Cleveland, Middletown, Cincinnati, Portsmouth	19.50	14.50	14.50	15.50	16.50	17.00	24.50	22.00	21.00	21.50	22.00	21.00	21.50	20.50	17.50	19.00	20.50
Chicago, Claymont, Coatesville, Conshohocken, Harrisburg, Phoenixville, Sparrows Point	18.75	13.75	13.75	14.75	15.75	16.25	23.75	21.25	20.25	20.75	21.25	20.25	20.75	19.75	16.75	18.25	19.75
Ashland, Ky.	19.50	14.50	14.50	15.50	16.50	17.00	24.50	22.00	21.00	21.50	22.00	21.00	21.50	20.50	17.50	19.00	20.50
Buffalo, N. Y.	19.25	14.25	14.25	15.25	16.25	16.75	24.25	21.75	20.75	21.25	21.75	20.75	21.25	20.25	17.25	18.75	20.25
Bethlehem, Pa.; Kokomo, Ind.	18.25	13.25	13.25	14.25	15.25	15.75	23.25	20.75	19.75	20.25	20.75	19.75	20.25	19.25	16.25	17.75	19.25
Duluth, Minn.	18.00	13.00	13.00	14.00	15.00	15.50	23.00	20.50	19.50	20.00	20.50	19.50	20.00	19.00	16.00	17.50	19.00
Detroit, Mich.	17.85	12.85	12.85	13.85	14.85	15.35	22.85	20.35	19.35	19.85	20.35	19.35	19.85	18.85	15.85	17.35	18.85
Toledo, Ohio	.....	12.85	12.85	13.85	14.85	15.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo.	17.50	12.50	12.50	13.50	14.50	15.00	22.50	20.00	19.00	19.50	20.00	19.00	19.50	18.50	15.50	17.00	18.50
Atlanta, Ga.; Alabama City, Ala.; Birmingham, Los Angeles; Pittsburg, Cal.; San Francisco	17.00	12.00	12.00	13.00	14.00	14.50	22.00	19.50	18.50	19.00	19.50	18.50	19.00	18.00	15.00	16.50	18.00
Minnequa, Colo.	16.50	11.50	11.50	12.50	13.50	14.00	21.50	19.00	18.00	18.50	19.00	18.00	18.50	17.50	14.50	16.00	17.50
Seattle, Wash.	14.50	9.50	9.50	10.50	11.50	12.00	19.50	17.00	16.00	16.50	17.00	16.00	16.00	15.00	12.50	14.00	15.50

*Baled turnings are $5 per gross ton higher.

BUNDLES: Tin can bundles are $4 below dealers' No. 2 bundles No. 3 bundles are $2 less than No. 1 heavy melting.

AT NEW YORK city or Brooklyn, the maximum shipping point price is $15.33 for No. 1 heavy melting, f.o.b. cars, f.a.s. vessel or loaded on truck. Minimum set at $14 per gross ton at any shipping point in U. S. Other grades carry differentials similar to those in table. New Jersey prices must be computed on basis of all-rail. At Boston the maximum is $15.05 for No. 1 f.o.b. cars, f.a.s. vessel or loaded on trucks. Shipments from a New England shipping point to a consumer outside New England carry maximum transportation charge of $6.66 per ton.

SWITCHING CHARGES: Deductions for shipping points within basing points (cents per gross ton) are: Pittsburgh, Brackenridge, 55c.; Midland, Johnstown, Sharon, Youngstown, Warren, Weirton, Cleveland, Toledo, Los Angeles, San Francisco, 42c.; Butler, Monessen, Canton, Steubenville, Cincinnati*, Portsmouth, Ashland, Coatesville, Harrisburg, Phoenixville, Bethlehem, Kokomo, Duluth, St. Louis, 28c.; Buffalo, Claymont, 36c.; Conshohocken, 11c.; Atlanta, Birmingham, 32c.; Pittsburg, Cal., 42c.; Middletown, 14c.; Sparrow's Point, 11c.; Chicago, 84c.; Detroit, 53c.; Alabama City, 26c.; Minnequa, 22c.; Seattle, 38c. *At Cincinnati, for basic open hearth grades, foundry steel and auto springs and crankshafts, deduct 80c. per ton.

PITTSBURGH basing point includes switching districts of Bessemer, Homestead, Duquesne, Munhall and McKeesport, Cincinnati basing point includes Newport, Ky., switching district. St. Louis includes switching districts of Granite City, East St. Louis, Madison, Ill. San Francisco includes switching districts of S. San Francisco, Niles and Oakmont, Cal. Claymont, Del., includes the switching point of Chester, Pa. Chicago includes Gary, Ind., switching district.

MAXIMUM SHIPPING POINT PRICE—Where shipment is by rail or vessel, or by combination of rail and vessel, the scrap is at its shipping point when placed f.o.b. railroad or f.a.s. vessel. In such cases, the maximum shipping point prices shall be: (a) For shipping points located within a basing point, the price listed in the table above for the scrap at the basing point in which the shipping point is located, minus the lowest established switching charge for scrap within the basing point and (b) for shipping points located outside the basing point, the price in table above at the most favorable basing point minus the lowest transportation charge by rail or water or combination thereof. In lieu of dock charge add 75c. a ton*, but 50c. if moved by deck scow or railroad lighter. Shipping by motor vehicle: The scrap is at its shipping point when loaded. For shipping points located within basing points take price listed in table minus applicable switching charge. If located outside a basing point, the price at the most favorable basing point minus lowest established charge for transporting by common carrier. If no established transportation rate exists, the customary costs are deducted. Published dock charges prevail. If unpublished include 75c.* For exceptions see official order.

UNPREPARED SCRAP: For unprepared scrap, maximum prices shall be $3.50 (and in the case of the material from which No. 1, No. 2, and No. 3 bundles are made $4) less maximum prices for the corresponding grade or grades of prepared scrap. In no case, however, shall electric furnace and foundry grades be used as the "corresponding grade or grades of prepared scrap." Converter may charge $2.50 per ton on consumer-owned unprepared remote scrap (see order). A preparation-in-transit charge for allocated unprepared scrap is provided.

NEW LISTED GRADES: Priced in dollars per gross ton less than No. 1 heavy melting steel. **Pit scrap, ladle skulls, slag reclaim,** etc., of 85% or more Fe priced—$2; 75 to 85% Fe—$4; under 75% Fe—$8 per ton. Mill scale of 65% or more Fe—$8 per ton. **Mill cinder and grindings,** shipping point maximum price of $4 per gross ton at all U. S. shipping points.

CHEMICAL BORINGS: No. 1 (new, clean, containing not more than 1 per cent oil), $1 less than No. 1 heavy melting; No. 2 (new, clean, containing not more than 1.5 per cent oil), $2 less than No. 1 heavy melting. If loaded in box cars add 75c.

*At Memphis 50c.; Great Lakes ports $1; New England $1.25.

RAILROAD SCRAP

	No. 1 RR Heavy Melting	Scrap Rails	Rails for Rerolling	Scran Rails 3 ft. and Under	Scran Rails 2 ft. and Under	Scran Rails 18 in. and Under
Cleveland, Cincinnati, Ashland, Portsmouth, Middletown	$20.50	$21.50	$23.00	$23.50	$23.75	$24.00
Canton, Pittsburgh, Sharon, Steubenville, Wheeling, Youngstown	21.00	22.00	23.50	24.00	24.25	24.50
Chicago, Philadelphia, Sparrows Pt., Wilmington	19.75	20.75	22.25	22.75	23.00	23.25
Birmingham, Los Angeles, San Francisco	18.00	19.00	20.50	21.00	21.25	21.50
Buffalo	20.25	21.25	22.75	23.25	23.50	23.75
Detroit	18.85	19.85	21.35	21.85	22.10	22.35
Duluth	19.00	20.00	21.50	22.00	22.25	22.50
Kansas City, Mo.	17.00	18.00	19.50	20.00	20.25	20.50
Kokomo, Ind.	19.25	20.25	21.75	22.25	22.50	22.75
Seattle	15.50	16.50	18.00	18.50	18.75	19.00
St. Louis	18.50	19.50	21.00	21.50	21.75	22.00

CAST IRON SCRAP

	Group A	Group B	Group C
No. 1 cupola cast	$18.00	$19.00	$20.00
Clean auto cast	18.00	19.00	20.00
Unstripped motor blocks	15.50	16.50	17.50
Stove Plate	17.00	18.00	19.00
Heavy Breakable Cast	15.50	16.50	17.50
Charging Box Size Cast	17.00	18.00	19.00
Misc. Malleable	20.00	21.00	22.00

Group A includes the states of Montana, Idaho, Wyoming, Nevada, Utah, Arizona and New Mexico.

Group B includes the states of North Dakota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas and Florida.

Group C: States not named in A and B: switching district of Kansas City, Kan., Mo.

Tool Steel Scrap Ceiling Prices Set by MPR 379, May 4, 1943

BASE PRICE SEGREGATED

	Solids, Lb. Cont. W	Turnings, Lb. Cont. W
Type 1	$1.80	$1.60
Type 2	1.60	1.40
Type 3	1.25	1.25
Type 4*	0.125	0.105
Type 5*	0.135	0.115

*Per lb. of scrap material.

BASE PRICE UNSEGREGATED SOLIDS

$1.50 per lb. contained W if 5% or more.

$1.15 per lb. contained W if over 1% and less than 5%.

$0.80 per lb. contained Mo if 1½% or more.

BASE PRICE UNSEGREGATED TURNINGS

$1.30 per lb. contained W if 5% or more.

$1.00 per lb. contained W if 1% and less than 5%.

$0.70 per lb. contained Mo if 1½% or more.

Comparison of Prices . . .

Advances Over Past Week in **Heavy Type**; Declines in *Italics*. [Prices Are F.O.B. Major Basing Points]

Flat Rolled Steel: (Cents Per Lb.)	June 22, 1943	June 15, 1943	May 25, 1943	June 23, 1942
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Plates, wrought iron	3.80	3.80	3.80	3.80
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate, standard cokes	$5.00	$5.00	$5.00	$5.00
Tin plate, electrolytic	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wrought iron bars	4.40	4.40	4.40	4.40
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

Pig Iron: (Per Gross Ton)	June 22, 1943	June 15, 1943	May 25, 1943	June 23, 1942
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.89	$25.89
No. 2, Valley furnace	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti	24.68	24.68	24.68	24.68
No. 2, Birmingham	20.38	20.38	20.38	20.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa.	25.39	25.39	25.39	25.39
Basic, Valley furnace	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago	31.34	31.34	31.34	31.34
Ferromanganese	135.00	135.00	135.00	135.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.
‡For carlots at seaboard.

Scrap: (Per Gross Ton)				
Heavy melt'g steel, P'gh.	$20.00	$20.00	$20.00	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	18.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	18.75
No. 1 hy. comp. sheet, Det.	17.85	17.85	17.85	17.85
Low phos. plate, Youngs'n	22.50	22.50	22.50	22.50
No. 1 cast, Pittsburgh	20.00	20.00	20.00	20.00
No. 1 cast, Philadelphia	20.00	20.00	20.00	20.00
No. 1 cast, Ch'go	20.00	20.00	20.00	20.00
Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$6.50	$6.50	$6.50	$6.00
Foundry coke, prompt	7.50	7.375	6.875	6.875
Non-Ferrous Metals: (Cents per Lb. to Large Buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake, New York	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	8.25
Lead, St. Louis	6.35	6.35	6.35	6.35
Aluminum, Virgin, del'd.	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	22.50
Antimony (Asiatic), N.Y.	16.50	16.50	16.50	16.50

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 139 and 149.

Composite Prices . . .

	FINISHED STEEL	PIG IRON	SCRAP STEEL
June 22, 1943	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.26190c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton

	FINISHED STEEL HIGH	FINISHED STEEL LOW	PIG IRON HIGH	PIG IRON LOW	SCRAP STEEL HIGH	SCRAP STEEL LOW
1943	2.25513c.,	2.25513c.,	$23.61	$23.61	$19.17	$19.17
1942	2.26190c.,	2.26190c.,	23.61	23.61	19.17	19.17
1941	2.43078c.,	2.43078c.,	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 10
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.67, June 9
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.99626c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

Weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Information Free

(1) Taps:

Attractive booklet tells about taps—explains thread terms, thread forms, types of taps, class fits, use and abuse of taps, how Threadwell taps are made, etc. Printed to help distributors to know their taps. Of equal interest to tap users. *Threadwell Tap & Die Company.*

(2) Metal Cleaning Handbook:

The first half of the manual is devoted to cleaning materials and the factors governing the selection of solvent cleaners, petroleum spirit cleaning, alkaline cleaners and emulsifiable cleaners. The second section is a complete treatise on modern metal washing machines from simple dip tanks to fully automatic continuous conveyor machines. *Magnus Chemical Company.*

(3) Induction Heating:

Describes the machines and methods for the induction heating and quenching of internal surfaces. In less than a minute the heating head and quenching device are inserted into the bore of the piece, the part heated and quenched and the head withdrawn. A summary of facts of the induction heating process is also included. *Budd Induction Heating, Inc.*

(4) Diamonds In Industry:

Progress in the field of industrial diamond tools has advanced proportionately with progress in other fields of science and industry. It is with this idea in mind that we supply technical information regarding diamond tools in industry, showing many special applications, of which relatively little was formerly known. *J. K. Smit & Sons, Inc.*

(5) Internal Grinding Wheels:

"Internal Grinding with Sterling Grinding Wheels" is the title of 6-page illustrated folder. Wheels are used for finishing surfaces of straight, cylindrical, tapered, straight and formed holes. Recommended specifications for internal grinding of various kinds of materials are listed. *Sterling Grinding Wheel Div., Cleveland Quarries Co.*

(6) Electric Welders:

4-page illustrated bulletin "A Dozen Ways to Conserve Critical Materials," describes tool and maintenance welders of flash type which may be used for toolmaking and repair operations. Capacities range from 5 to 300 kilovolt-amperes. Typical weldments which may be performed are shown. *Thomson-Gibb Electric Welding Co.*

(7) Fastening Devices:

4-page data bulletin No. 171 is suggested list of typical non-structural "Speed Nut" applications in aircraft. Types which conform to various specifications, for use with machine screws and sheet metal screws, are covered. *Tinnerman Products, Inc.*

(8) Hard Chrome Plating:

8-page illustrated bulletin, "Beat the Small Tool Shortage," discusses hard chrome plating as "presalvage" treatment of files, gages, cutters, drills, reamers, dies, broaches and other small tools. Tools may be restored to dimension by hard chrome plating and grinding. They will often last ten times longer than ordinary tools. Plating equipment is described. *Udylite Corp.*

(9) Milling & Boring Machines:

Booklet illustrates and describes an extensive line of multiple head milling machines in duplex, rotary and planer types for special classes of production work. A large 200" lathe adjustable up to 16 feet between centers is shown tooled up. Also boring machines in horizontal, duplex, and vertical types. *Fitchburg Engineering Corp.*

(10) X-Ray Illuminator:

High intensity illuminator, illustrated and described in a pamphlet, has been designed to provide a variable degree of illumination from low to very high intensity. Also illustrated are film filing cabinets and X-ray film envelopes. *Picker X-Ray Corp.*

(11) Blackening of Metals:

Several folders describing processes used in blackening various metals and their respective alloys. Ebonal "A" covers aluminum, "C" copper, "Z" zinc, and "S" iron and steel. Characteristics of the coatings, specific operating details and general information on the processes are given. *The Enthone Co.*

(12) Micromax Pneumatic Control:

Catalog N-OOB on Micromax Pneumatic Control stresses the use of this equipment for regulation of pH, conductivity and other conditions, as well as temperature. Catalog gives standard ranges, dimensions, shipping weights, etc. *Leeds & Northrup Co.*

(13) Zinc Alloy Die Casting:

Booklet covers salient features of zinc, and method or production. Questions and answers enable users to evaluate die castings for war and post-war products. *The New Jersey Zinc Co.*

(14) Planers and Milling Machines:

A 27-page booklet, Bulletin No. 153, illustrates and describes double housing and open side planers, planer type millers and vertical boring mills. Specifications are given for each machine. *The Cincinnati Planer Co.*

(15) Hardening High Speed Steel:

Folder illustrates and describes atmospheric pot furnaces and liquid baths for increasing the surface hardness of high speed tools previously hardened, tempered and ground to size. *The A. F. Holden Co.*

(16) Synthetic Foundry Sand:

Bulletin on molding sand usage; changing conditions of the sand in the mold while hot, during pouring and until casting is removed from the sand, and when cool, after shaking out. Includes graphic portrayal of progressive reactions of six synthetic sands. *American Colloid Co.*

(17) Industrial Ovens:

Illustrated 16-page booklet features various types of industrial ovens and their operating characteristics. *The Lanley Co.*

(18) Hardness Tester:

Booklet illustrates micro hardness tester and accessories. Describes its characteristics and gives complete erectional data. *Eberbach & Son Co.*

(19) Magnesium Scrapbook:

Booklet consolidates and presents some essential facts on production and use of magnesium alloys. *Fisher Furnace Co.*

(20) Universal Joint:

Profusely illustrated 47-page book covers design, installation and operation of remote controls by means of flexible shaft joints operating at angles from 0 deg. to 360 deg. in any plane. *Brooks Equipment Corp.*

NOTICE TO READERS: Your request for this information will be forwarded promptly to the manufacturer issuing the literature, and the offer is good for only two months.

6/24/43

THE IRON AGE, New York 17, N. Y.

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INFORMATION FREE (Continued)

(21) Heat Treating Light Metals:

Bulletin 140 illustrates furnace types, describes zone control method of heating large loads, and lists construction features and sizes available. *Lindberg Engineering Co.*

(22) Floor Gratings:

8-page pamphlet on various types of metal floor gratings and safety steps, together with data on safe loads. *Borden Metal Products Co.*

(23) Milling Machine Methods:

Handbook of 86 pages, illustrating by text and drawings, the wide range of work currently being performed on millers. Suggests use of less expensive machinery and less horsepower, as well as speedier work in a smaller area of floor space. Gives hints on means of saving time, money and material through ingenuity. *Nichols-Morris Corp.*

(24) Salt Bath Furnace:

Bulletin 110 discusses the part salt baths play in hardening armor-piercing shot, precision screw products, aluminum sections for airplanes, etc. *The Ajax Electric Co., Inc.*

(25) Automatic Screw Machine:

Bulletin No. 1800-A, a 15-page pamphlet, describes and illustrates precision automatic screw machine constructional details and operating practices. *George Gorton Machine Co.*

(26) Dial Indicator:

Adaptability and accuracy of a universal type of dial indicator, the Testmaster, together with various adaptor rods which can be used in conjunction with it, are described in 4-page illustrated circular. *Federal Products Corp.*

(27) lignum-Vitae Wartime Uses:

Booklet discusses many diversified and some heretofore unknown applications of Lignum-Vitae for war goods, also many interesting uses before the war and potential uses in the post-war period. *Lignum-Vitae Products Corp.*

(28) Cutter Grinder:

48-page manual is descriptive of 30" cutter grinder and special attachments. Intended to assist the operator in best methods of grinding, it also contains valuable information on good milling cutter grinding practice which is of interest to both operators and supervisors. *The Ingersoll Milling Machine Co.*

(29) Meehanite Metal:

Handbook containing 52 pages of text and pictures, gives story of the manufacture, metallurgy and engineering properties of Meehanite. Also contains brief description of company's plant and facilities. Lists places where Meehanite castings are satisfactorily replacing bronzes, brasses, steels, steel castings and forgings, aluminum and other currently critical materials. *The Hamilton-Foundry & Machine Co.*

(30) Honing Machine:

Bulletin 121-H covers general treatise on the subject of honing. 16-page pamphlet is descriptive of honing process and self-oiling hydraulic honing machines. Illustrates largest internal honing machine, hydraulically operated, in the world. *Barnes Drill Co.*

(31) Tube Bending:

Profusely illustrated booklet discusses tube bending of aluminum intakes, steel intakes, oil lines, complicated assemblies, brazing, manifolds, and checking fixtures. *American Tube Bending Co., Inc.*

(32) Steel Handbook:

"The Steel Handbook No. 42" is a collection of data and other information designed to aid the steel user in selecting the right steel for the right purpose, and in securing Highest Efficiency in his production process. *Union Drawn Steel Div., Republic Steel Corp.*

(33) Dust and Fume Control Equipment:

Photographic illustrations in this 42-page book show actual installations of dust-and-fume control equipment, spray booths, mechanical washers, industrial ovens. Reproduction of blueprints given engineering details, capacities and dimensions of various dust removal units. A section is devoted to sheet metal equipment with built-in systems for removal of fumes or dust in welding, grinding, buffing and similar operations. *Schmieg Industries.*

(34) Training Program

To guide the training of students of the Apprentice School, B. F. Goodrich Co.'s 26-page manual outlines all the details of the various courses of study conducted by the school. Explanation of the school's purpose, method of selecting students, administration of the program, cooperative plan with the local board of education, ratio of apprentices to journeymen, and length of time required in each of the courses are among the topics discussed. *B. F. Goodrich Co.*

(35) Chucking Fixture:

8-page illustrated folder features the "Zagar" collet chucking fixture, a universal device for indexing and holding work on machine tools, and gives details of design, operation and typical applications. *Zagar Tool, Inc.*

(36) Drives and Couplings:

64-page illustrated catalog No. 642 shows complete line of chains, sprockets and couplings for positive power transmission. Advantages claimed for chain drives, typical installations and engineering data on chain drives are covered. Flexible couplings for all types of applications, as well as miscellaneous power transmission equipment, are described. *Ramsey Chain Co.*

(37) Electrical Controls:

45-page illustrated catalog, "Air-Line," contains descriptive and engineering data pertaining to wide variety of light weight electrical control devices for 12 and 24 volts, d.c. Designed primarily for aircraft and tank use, they can also be used on boats, trucks and other types of portable or mobile equipment. They will operate in any mounting position under severe conditions of vibration, acceleration, temperature and pressure. *Square D Co.*

(38) Furnace Atmospheres:

12-page illustrated catalog entitled "The SC Primer of Prepared Atmospheres" is concerned with various types of furnace atmospheres, their preparation, application and relative cost. Effect upon steel of most common gases encountered in prepared atmospheres is summarized. Typical installations of controlled atmosphere furnaces are shown. *Surface Combustion.*

(39) Aluminum Welding:

4-page technical paper gives details of procedure involved in "Koldweld" cold dip method in use for cleaning and deoxidizing aluminum for spot welding. In addition to covering effectiveness of this process, suggested system is shown. Various solutions to be used are listed. *Turco Products, Inc.*

(40) Synthetic Rubber:

40-page illustrated bulletin No. 43-1 is entitled "The Five Commercial Types of Synthetic Rubber." Full data and properties are given on "Buna S," "Buna N," "Neoprene," butyl and "Thiokol" types of synthetic rubbers. Properties of natural and synthetic rubbers are compared, and manufacture of various types is explained. *United States Rubber Co.*

6/24/43

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NEW YORK 17, N. Y.

Prices of Finished Iron and Steel . . .

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, reductions, and in most cases freight absorbed to meet competition. Delivered prices do not reflect new 3 per cent tax on freight rates.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars[10]	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	3.67¢
Long ternes[2]	3.80¢		3.80¢									4.55¢		4.16¢	4.12¢
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢			2.95¢			2.95¢	(Worcester = 3.35¢)					3.05¢	3.31¢	
TIN MILL PRODUCTS															
Coke tin plate, base box	$5.00	$5.00	$5.00						$5.10					5.36¢	5.32¢
Electrolytic tin plate, box	$4.50		$4.50												
Black plate, 29 gage[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢[12]			3.37¢
Mfg. ternes, special box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢	2.80¢			
Reinforcing (billet)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢[13]	2.25¢	2.39¢	
Reinforcing (rail)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢[13]	2.25¢		2.47¢
Cold finished[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢			(Detroit = 2.70¢)					2.99¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢	(Bethlehem, Massillon, Canton = 2.70¢)						2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
								(Coatesville and Claymont = 2.10¢)							
PLATES															
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	2.35¢		2.45¢	2.65¢	2.31¢	2.29¢	2.15¢
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	3.67¢
Alloy	3.50¢	3.50¢			(Coatesville = 3.50¢)						3.95¢	4.15¢		3.70¢	3.59¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	(Bethlehem = 2.10¢)				2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)								
WIRE[9]															
Bright[15]	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Galvanized	add proper size extra and galvanized extra to bright wire base, above.														
Spring (High Carbon)	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)					3.70¢			3.52¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢

[1] Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to certain width and length limitations. [6] For merchant trade. [7] Prices for straight length material only, from a producer to a consumer. Functional discount of 25c. per 100 lb. to fabricators. [8] Also shafting. For quantities of 20,000 to 29,999 lb. [9] Carload lot to manufacturing trade. [10] These prices do not apply if the customary means of transportation (rail and water) are not used. [12] Boxed. [13] Portland and Seattle price, San Francisco price is 2.50c. [14] This bright wire base price to be used in figuring annealed and bright finish wires, commercial spring wire and galvanized wire.

GOVERNMENT CEILING—Price Schedule No. 6 issued April 16, 1941, governs steel mill prices; Price Schedule No. 49 governs warehouse prices which are on another page of this issue.

EXCEPTIONS TO PRICE SCHEDULE No. 6—On hot rolled carbon bars, Phoenix Iron Co. may quote 2.35c. at established basing points, Calumet Steel division of Borg Warner may quote 2.35c., Chicago, on bars from its 8-in. mill; Joslyn Mfg. Co. may quote 2.35c., Chicago base. On rail steel bars Sweets Steel Co. may quote 2.35c., f.o.b. mill. On hot rolled sheets, Andrews Steel Co. may quote for shipment to Detroit area on Middletown base. On galvanized sheets, Andrews Steel may quote 3.75c., at established basing points. On hot rolled strip, Joslyn Mfg. Co. may quote 2.30c., Chicago base. On plates, Granite City Steel Co. may quote 2.35c., f.o.b. mill, and Central Iron & Steel Co. may quote 2.20c., f.o.b. basing points. On shapes, Phoenix Iron Co. may quote 2.30c. established basing points and 2.50c. Phoenixville for export.

On rail steel merchant bars, Eckels-Nye Corp. may charge 2.40c. On tubing, South Chester Tube Co. may price Gulf or Pacific Coast all-rail shipments and shipments west of Harrisburg on basis of f.o.b. Chester. On lend-lease sales to eastern seaboard, Sheffield Steel Co. and Colorado Fuel & Iron Corp. may sell f.o.b. mill. SEMIFINISHED STEEL—Follansbee Steel Corp. may sell forging billets at $49.50 f.o.b. Toronto; Continental Steel Corp. may sell Acme Steel Co. at $34 for rerolling billets plus extras and freight; Ford Motor Co. may sell rerolling billets at $34 f.o.b. Dearborn; Andrews Steel Co. may sell forging billets at $50 at established basing points and slabs at $41; Empire Sheet and Tin Plate may sell slabs at $41 at established basing points and sheet bars at $39 f.o.b. mill; on lend-lease sales Northwestern Steel & Wire Co. may charge $41 per gross ton f.o.b. mill for rerolling billets; on lend-lease sales Wheeling Steel Corp. may charge $36 per ton for small billets, f.o.b. Portsmouth and $37 per ton for sheet bars f.o.b. Portsmouth; Laclede Steel Co. on semifinished sales for lend-lease shipped to eastern seaboard may use Chicago basing point prices f.o.b. Alton and Madison, Ill. ALLOY STEEL BARS—Texas Steel Co. may use Chicago base f.o.b. Fort Worth.

WAREHOUSE PRICES

(Delivered Metropolitan areas, per 100 lb. These prices do not necessarily apply for dislocated tonnage shipments when the f.o.b. City prices are used in conformance with OPA Schedule 49)

Cities	SHEETS			STRIP		Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
	Hot Rolled (10 gage)	Cold Rolled	Galvanized (24 gage)	Hot Rolled	Cold Rolled			Hot Rolled	Cold Finished	†† Hot Rolled, 2300	‡ Hot Rolled, 3100	†† Cold Drawn, 2300	‡ Cold Drawn, 3100
*Philadelphia	$3.518	$4.872[5]	$5.018	$3.922	$4.772	$3.605	$3.666	$3.822	$4.072	....	$7.116	....	....
*New York	3.590	4.613[2]	5.010	3.974[6]	4.774	3.768	3.758	3.853	4.103	6.008	7.158	7.303	8.453
*Boston	3.774	4.744	5.224	4.106	4.715	3.912	3.912	4.044	4.144	6.162	7.312	7.344	8.494
*Baltimore	3.394	4.852	4.894	3.902	4.752	3.594	3.759	3.802	4.052	....	....	....	....
*Norfolk	3.771	4.965	5.371	4.165	4.865	3.971	4.002	4.065	4.165	....	....	....	....
*Washington	3.596	4.841	5.196	4.041	4.741	3.796	3.930	3.941	4.041	....	....	....	....
Pittsburgh	3.35	4.00	4.75	3.60	3.20	3.40	3.40	3.35	3.65	7.45	5.75	8.40	6.75
Chicago	3.25	4.10	4.85[1]	3.60	3.50	3.55	3.55	3.50	3.75	7.35	5.65	8.40	6.75
Cleveland	3.35	4.05	4.62	3.50	3.20	3.40	3.58	3.25	3.75	7.55	5.85	8.40	6.75
Detroit	3.43	4.30	4.84[1]	3.43	3.40	3.60	3.65	3.43	3.80	7.67	5.97	8.70	7.05
Buffalo	3.25	4.30[1]	4.75[4]	3.82	3.52	3.62	3.40	3.35	3.75	7.35	5.65	8.40	6.75
Birmingham	3.45[3]	....	4.75[1]	3.70[3]	....	3.55[3]	3.55[3]	3.50[3]	4.43	....	....	....	....
St. Louis	3.39	4.24[2]	4.99[1]	3.74	3.61	3.69	3.69	3.64	4.02	7.72	6.02	8.77	7.12
St. Paul	3.50	4.35	5.00	3.85	3.83	3.80	3.80	3.75	4.34	7.45	6.00	8.84	7.44
Milwaukee	3.38	4.23[2]	4.98[1]	3.73	3.54	3.68	3.68	3.63	3.88	7.58	5.88	8.63	6.98
Cincinnati	3.42	4.37[2]	4.42[1]	3.67	3.45	3.65	3.68	3.60	4.00	7.69	5.99	8.50	7.10
Indianapolis	3.45	4.25	5.01[1]	3.75	3.28	3.70	3.70	3.60	3.97	7.67	5.97	8.72	7.07
Omaha	3.85	4.77	5.52[1]	4.20	....	4.15	4.15	4.10	4.42	....	....	....	....
Memphis	3.85	4.66	5.25	4.10	....	3.95	3.95	3.90	4.31	....	....	....	....
New Orleans	3.95	4.95	5.25	4.20	....	3.90	3.90	4.10	4.60	....	....	....	....
Houston	3.75	5.43	5.25	4.30	....	5.25	5.25	3.75	4.50	....	....	....	....
†Los Angeles	4.95	7.15	5.95	4.90	....	4.90	4.60	4.35	5.70	9.55	8.55	10.55	9.55
†San Francisco	4.55	7.55	6.60	4.50	....	4.65	4.35	3.95	5.55	9.80	8.80	10.80	9.80
†Seattle	4.65[7]	6.63	5.70[7]	4.25	....	4.75	4.45	4.20	5.75	....	8.00	....	....

N. E. STEELS

(Hot Rolled Mill Extras for Alloy Content)

Designation	CHEMICAL COMPOSITION LIMITS, PER CENT								Basic Open-Hearth		Electric Furnace	
	Carbon	Manganese	Phosphorus Max.	Sulphur Max.	Silicon	Chromium	Nickel	Molybdenum	Bars and Bar Strip	Billets, Blooms and Slabs	Bars and Bar Strip	Billets, Blooms and Slabs
NE 1330	.28/ .33	1.60/1.90	.040	.040	.20/ .35	....	....	....	.10c	$2.00	....	....
NE 1335	.33/ .38	1.60/1.90	.040	.040	.20/ .35	....	....	....	.10	2.00	....	....
NE 1340	.38/ .43	1.60/1.90	.040	.040	.20/ .35	....	....	....	.10	2.00	....	....
NE 1345	.43/ .48	1.60/1.90	.040	.040	.20/ .35	....	....	....	.10	2.00	....	....
NE 1350	.48/ .53	1.60/1.90	.040	.040	.20/ .35	....	....	....	.10	2.00	....	....
NE 8020	.18/ .23	1.00/1.30	.040	.040	.20/ .35	....	....	.10/ .20	.45	9.00	.95c	$19.00
NE 8442*	.40/ .45	1.30/1.60	.040	.040	.20/ .35	....	....	.30/ .40	.90	18.00	1.40	28.00
NE 8613	.12/ .17	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8615	.13/ .18	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8617	.15/ .20	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8620	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8630	.28/ .33	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8635	.33/ .38	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8637	.35/ .40	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8640	.38/ .43	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8642	.40/ .45	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8645	.43/ .48	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8650	.48/ .53	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8720	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.20/ .30	.80	16.00	1.30	26.00
NE 9255	.50/ .60	.70/ .95	.040	.040	1.80/2.20	....	....	....	.40c	8.00	....	....
NE 9260	.55/ .65	.75/1.00	.040	.040	1.80/2.20	....	....	....	.40	8.00	....	....
NE 9262	.55/ .65	.75/1.00	.040	.040	1.80/2.20	.20/ .40	....	....	.65	13.00	....	....
NE 9415	.13/ .18	.80/1.10	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.80	16.00	1.30c	$26.00
NE 9420	.18/ .23	.80/1.10	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.80	16.00	1.30	26.00
NE 9422	.20/ .25	.80/1.10	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.80	16.00	1.30	26.00
NE 9430	.28/ .33	.90/1.20	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.80	16.00	1.30	26.00
NE 9435	.33/ .38	.90/1.20	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.80	16.00	1.30	26.00
NE 9437	.35/ .40	.90/1.20	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.80	16.00	1.30	26.00
NE 9440	.38/ .43	.90/1.20	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.80	16.00	1.30	26.00
NE 9442	.40/ .45	1.00/1.30	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.85	17.00	1.35	27.00
NE 9445	.43/ .48	1.00/1.30	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.85	17.00	1.35	27.00
NE 9450	.48/ .53	1.20/1.50	.040	.040	.40/ .60	.20/ .40	.20/ .50	.08/ .15	.85	17.00	1.35	27.00
NE 9537*	.35/ .40	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9540*	.38/ .43	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9542*	.40/ .45	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9550*	.48/ .53	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9630	.28/ .33	1.20/1.50	.040	.040	.40/ .60	.40/ .60	....	....	.80	16.00	1.30	26.00
NE 9635	.33/ .38	1.20/1.50	.040	.040	.40/ .60	.40/ .60	....	....	.80	16.00	1.30	26.00
NE 9637	.35/ .40	1.20/1.50	.040	.040	.40/ .60	.40/ .60	....	....	.80	16.00	1.30	26.00
NE 9640	.38/ .43	1.20/1.50	.040	.040	.40/ .60	.40/ .60	....	....	.80	16.00	1.30	26.00
NE 9642	.40/ .45	1.30/1.60	.040	.040	.40/ .60	.40/ .60	....	....	.85	17.00	1.35	27.00
NE 9645	.43/ .48	1.30/1.60	.040	.040	.40/ .60	.40/ .60	....	....	.85	17.00	1.35	27.00
NE 9650	.48/ .53	1.30/1.60	.040	.040	.40/ .60	.40/ .60	....	....	.85	17.00	1.35	27.00

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb.; galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over: Exceptions: [1] 500 to 1499 lb. [2] 400 to 1499 lb. [3] 400 to 3999 lb. [4] 450 to 1499 lb. [5] 1000 to 1999 lb. [6] 0 to 1999 lb. [7] 300 to 10,000 lb. At Philadelphia galvanized sheets, 2500 more bundles; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; San Francisco, hot rolled sheets, 400 to 39,999 lb.; galvanized and cold rolled sheets, 750 to 4999 lb.; cold fin. bars, 0-299 lb.; hot rolled alloy bars, 0-4999 lb.; Seattle, cold finished bars, 1000 lb. and over, hot rolled alloy bars, 0-1999 lb.; Memphis, hot rolled sheets, 400 to 1999 lb., galvanized sheets, 150 and over; St. Paul, galvanized and cold rolled sheets, any quantity, hot rolled bars, plates, shapes, hot rolled sheets, 400 to 14,999 lb.; Los Angeles, hot rolled sheets, bars, plates, cold rolled sheets, 300 to 1999 lb.; galvanized sheets, 1 to 6 bundles; cold finished bars, 1 to 99 lbs.; SAE bars, 100 lb. Extras for size, quality, etc., apply on above quotations.

† Los Angeles, San Francisco and Seattle prices reflect special provisions of amendment No. 2 to OPA Price Schedule No. 49.

†† For zoned cities these grades have been revised to NE 8617-20.

* Base delivered prices according to price zones established by Amendment 14 to RPS 49 including the 3% transportation tax—not including the 6% freight increase of March 18, 1942, rescinded May 15, 1943.

‡ For zoned cities these grades have been revised to NE 9442-45 Ann'ld.

***Recommended for large sections only. Note: The extras shown above are in addition to a base price of 2.70c. per 100 lb., on finished products and $54 per gross ton on semi-finished steel major basing points and are in cents per 100 lb. and dollars per gross ton in semi-finished. When acid open-hearth is specified and acceptable add to basic open hearth alloy differential 0.25c. per lb. for bars and bar strip, $5.00 per gross ton for billets, blooms and slabs. The ranges shown above are restricted to sizes 100 sq. in. or less or equivalent cross sectional area 18 in. wide or under with a max. individual piece weight of 7000 lb.**

PRICES

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2.00 higher; f.o.b. Duluth, billets only, $2 higher. Delivered prices do not reflect new per cent tax on freight rates.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00
Alloy Steel: Pittsburgh, Chicago, Canton, Massillon, Buffalo, or Bethlehem, per gross ton	$54.00

Shell Steel

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Basic open hearth shell steel, f.o.b. Pittsburgh, Chicago, Buffalo, Gary, Cleveland, Youngstown and Birmingham.

Prices delivered Detroit are $2.00 higher.

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(*No. 5 to 9/32 in.*)

	Per Lb.
Pittsburgh, Chicago, Cleveland	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

TOOL STEEL

(*F.o.b. Pittsburgh, Bethlehem, Syracuse*)

	Base per lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi, 3c. higher.

CORROSION AND HEAT-RESISTING STEEL

(*Per lb. base price, f.o.b. Pittsburgh*)

Chromium-Nickel Alloys

	No. 304	No. 202
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.725c.	16.15c.	19.125c.	23.375c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hotstrip	17.00c.	17.50c.	24.00c.	35.00c.
Cold st.	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

PRICES

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts
(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts:

	Per Cent Off List
½ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1⅛ in. and larger, all length	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:
(Hexagon or Square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
7/16 in. and smaller	..	64
½ in. and smaller	62	..
⅝ in. through 1 in.	..	60
9/16 to 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full container lots, 10 per cent additional discount.

Stove Bolts

Packages, nuts loose	71 and 10
In packages, with nuts attached	71
In bulk	80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York on lots of 200 lb. or over.

Large Rivets *(½ in. and larger)*

	Base per 100 lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.75

Small Rivets *(7/16 in. and smaller)*

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 5

Cap and Set Screws

	Per Cent Off List
Upset full fin. hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Filister head cap, listed sizes	51

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

RAILS, TRACK SUPPLIES
(F.o.b. Mill)

Standard rails, heavier than 60 lb., gross ton	$40.00
Angle bars, 100 lb.	2.70
(F.o.b. Basing Points)	*Per Gross Ton*
Light rails (from billets)	$40.00
Light rails (from rail steel)	39.00

	Base per Lb.
Cut spikes	3.00c.
Screw spikes	5.15c.
Tie plates, steel	2.15c.
Tie plates, pacific Coast	2.30c.
Track bolts	4.75c.
Track bolts, heat treated, to railroads	5.00c.
Track bolts, jobbers discount	63-5

Basing Points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond.

ROOFING TERNE PLATE
(F.o.b. Pittsburgh, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00

PRICES

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

F.o.b. Granite City, add 10c. per 100 lb. on field grade to and including dynamo. Pacific ports add 75c. per 100 lb. on all grades.

WIRE PRODUCTS

To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham

	Base per Keg
Standard wire nails	$2.55
Coated nails	2.55
Cutnails, carloads	3.85
	Base per 100 Lb.
Annealed fence wire	$3.05
Annealed galvanized fence wire	3.40
	Base Column
Woven wire fence*	67
Fence posts (carloads)	69
Single loop bale ties	59
Galvanized barbed wire†	70
Twisted barbless wire	70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

WELDED PIPE AND TUBING

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought pipe)
Base Price—$200 per Net Ton

Steel (Butt Weld)

	Black	Galv.
⅛ in.	63½	51
¼ in.	66½	55
⅜ to ½ in.	68½	57½

Wrought Iron (Butt Weld)

⅛ in.	25	3½
¼ in.	30	10
⅜ and ½ in.	34	16
¾ in.	38	18½
1 in.	37½	18

Steel (Lap Weld)

2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½

Wrought Iron (Lap Weld)

2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17

Steel (Butt, extra strong, plain ends)

	Black	Galv.
⅛ in.	61½	50½
¼ in.	65½	54½
⅜ to ½ in.	67	57

Wrought Iron (Same as Above)

⅛ in.	25	6
¼ in.	31	12
⅜ to ½ in.	38	19½

Steel (Lap, extra strong, plain ends)

2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56

Wrought Iron (Same as Above)

2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher on all butt weld.

PIG IRON

All prices set in bold face type are maxima established by OPA on June 24, 1941. Other domestic prices (in italics) are delivered quotations per gross ton computed on the basis of the official maxima. Delivered prices do not reflect 3 per cent tax on freight rates.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorus	Charcoal
Boston††	*$25.00*	*$24.50*	*$26.00*	*$26.50*	.....	.....
Brooklyn	*27.50*	.....	.....	*28.00*	.....	.....
Jersey City	*26.53*	*26.03*	*27.53*	*27.03*	.....	.....
Philadelphia	*25.84*	*25.34*	*26.84*	*26.34*	*$30.74*	.....
Bethlehem, Pa.	25.00	24.50	26.00	25.50	.....	.....
Everett, Mass.††	25.00	24.50	26.00	25.50	.....	.....
Swedeland, Pa.	25.00	24.50	26.00	25.50	.....	.....
Steelton, Pa.		24.50	.....	.....	29.50	.....
Birdsboro, Pa.	25.00	24.50	26.00	25.50	29.50	.....
Sparrows Point, Md.	25.00	24.50	.....	.....	.....	.....
Erie, Pa.	24.00	23.50	25.00	24.50	.....	.....
Neville Island, Pa.	24.00	23.50	24.50	24.00	.....	.....
Sharpsville, Pa.*	24.00	23.50	24.50	24.00	.....	.....
Buffalo	24.00	23.00	25.00	24.50	29.50	.....
Cincinnati, Ohio	*23.94*	*23.94*	.....	*25.11*	.....	.....
Canton, Ohio	*25.39*	*24.89*	*25.89*	*25.39*	*32.69*	.....
Mansfield, Ohio	*25.94*	*25.44*	*26.44*	*25.94*	*32.86*	.....
St. Louis	*24.50*	*24.50*	.....	.....	.....	.....
Chicago	24.00	23.50	24.50	24.00	*35.46*	*$31.34*
Granite City, Ill.	24.00	23.50	24.50	24.00	.....	.....
Cleveland	24.00	23.50	24.50	24.00	*22.42*	.....
Hamilton, Ohio	24.00	23.50	.....	24.00	.....	.....
Toledo	24.00	23.50	24.50	24.00	.....	.....
Youngstown*	24.00	23.50	24.50	24.00	*22.42*	.....
Detroit	24.00	23.50	24.50	24.00	.....	.....
Lake Superior fc.	.....	.....	.....	.....	.....	$28.00
Lyles, Tenn. fc.†	.....	.....	.....	.....	.....	33.00
St. Paul	*26.76*	.....	*27.26*	*26.76*	*39.80*	.....
Duluth	24.50	24.00	25.00	24.50	.....	.....
Birmingham	20.38	19.00	25.00	.....	.....	.....
Los Angeles	*26.95*	.....	.....	.....	.....	.....
San Francisco	*26.95*	.....	.....	.....	.....	.....
Seattle	*26.95*	.....	.....	.....	.....	.....
Provo, Utah	22.00	21.50	.....	.....	.....	.....
Montreal	*27.50*	*27.50*	.....	*28.00*	.....	.....
Toronto	*25.50*	*25.50*	.....	*26.00*	.....	.....

GRAY FORGE IRON: Valley or Pittsburgh furnace $23.50

*Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

**Pittsburgh Ferromanganese Co. (Chester furnace only) may charge $2.25 a ton over maximum basing point prices.

†Price shown is for low-phosphorous iron; high-phosphorous sells for $28.50 at the furnace.

††Eastern Gas & Fuel Associates, Boston, is permitted to sell pig iron produced by its selling company, Mystic Iron Works, Everett, Mass., at $1 per gross ton above maximum prices.

Delta Chemical & Iron Co., Chicago, may charge $30 for charcoal iron at its Delta, Mich., furnace.

Basing point prices are subject to switching charges; silicon differentials (not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade which is 1.75 per cent to 2.25 per cent); phosphorous differentials, a reduction of 38c. per ton for phosphorous content of 0.70 per cent and over; manganese differentials, a charge not to exceed 50c. per ton for each 0.50 per cent manganese content in excess of 1.00 per cent. Effective March 3, 1943, $2 per ton extra may be charged for 0.5 to 0.75 per cent nickel content and $1 per ton extra for each additional 0.25 per cent nickel.

Metal Powders

Prices are based on current market prices of ingots plus a fixed figure. For ton lots f.o.b. shipping point, in cents per lb.

Copper, electrolytic, 150 and 200 mesh	21⅛ to 23⅛c.
Copper, reduced, 150 and 200 mesh	20½ to 25⅛c.
Iron, commercial, 100 and 200 mesh	13½ to 15c.
Iron, crushed, 200 mesh and finer	4c.
Iron, hydrogen reduced, 300 mesh and finer	63c.
Iron, electrolytic, unannealed, coarser than 300 mesh	30 to 33c.
Iron, electrolytic, annealed minus 100 mesh	42c.
Iron, carbonyl, 300 mesh and finer	90c.
Aluminum, 100 and 200 mesh.	*23 to 27c.
Antimony, 100 mesh	20.6c.
Cadmium, 100 mesh	$1
Chromium, 150 mesh	$1.03
Lead, 100, 200 & 300 mesh,	11½ to 12½c.
Manganese, 150 mesh	51c.
Nickel, 150 mesh	51½c.
Solder powder, 100 mesh,	8½c. plus metal
Tin, 100 mesh	58¾c.

*Freight allowed east of Mississippi.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes, Minimum Wall. Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots.

	Seamless Cold Drawn	Lap Weld, Hot Rolled	Seamless Hot Rolled
2 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.58
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.86

(Extras for less carload quantities)

40,000 lb. or ft., and over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

PRICES

CAST IRON WATER PIPE

	Per Net Ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. cars, San Francisco or Los Angeles	69.40
6-in. and larger f.o.b. cars, Seattle	71.20

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago, $59.40 at San Francisco and Los Angeles, and $70.20 at Seattle. Delivered prices do not reflect new 3 per cent tax on freight rates.

LAKE SUPERIOR ORES

(51.50% *Fe, Natural Content, Delivered Lower Lake Ports**)

	Per Gross Ton
Old range, bessemer, 51.50	$4.75
Old range, non-bessemer, 51.50	4.60
Mesaba, bessemer, 51.50	4.60
Mesaba, non-bessemer, 51.50	4.45
High phosphorous, 51.50	4.35

*Adjustments are made to indicated prices based on variance of Fe content of ores as analyzed on a dry basis by independent laboratories.

COKE

Furnace

	Per Net Ton
†Connellsville, prompt	$6.50*

Foundry

†Connellsville, prompt	$7.50
Fayette County, W. Va. (Beehive)	$8.10
By-product, Chicago	$12.25
By-product, New England	$13.75
By-product, Newark	$12.40 to $12.95
By-product, Philadelphia	$12.38
By-product, Cleveland	$12.30
By-product, Cincinnati	$11.75
By-product, Birmingham	$8.50†
By-product, St. Louis	$12.02
By-product, Buffalo	$12.50

Maximum by-product coke prices established by OPA became effective Oct. 1, 1941.

*Hand-drawn ovens using trucked coal are permitted to charge $7.00 per net ton, plus usual transportation. Maximum beehive furnace coke prices established by OPA, Feb. 8, 1942. †F.o.b. oven.

FLUORSPAR

	Per Net Ton
Domestic washed gravel, 85-5 f.o.b. Kentucky and Illinois mines, all rail	$25.00
Domestic, f.o.b. Ohio River landing barges	25.00
No. 2 lump, 85-5 f.o.b. Kentucky and Illinois mines	25.00

REFRACTORIES

(*F.o.b. Works*)

Fire Clay Brick	*Per 1000*
Super-duty brick, St. Louis	$64.60
First quality, Pa., Md., Ky., Mo., Ill.	51.30
First quality, New Jersey	56.00
Sec. quality, Pa., Md., Ky., Mo., Ill.	46.55
Second quality, New Jersey	51.00
No. 1, Ohio	43.00
Ground fire clay, net ton	7.60

Silica Brick

Pennsylvania & Birmingham	$51.30
Chicago District	58.90
Silica cement, net ton (Eastern)	9.00

Chrome Brick	*Per Net Ton*
Standard, chemically bonded, Balt., Plymouth Meeting, Chester	$54.00

Magnesite Brick

Standard, Balt. and Chester	$76.00
Chemically bonded, Baltimore	65.00

Grain Magnesite

Domestic, f.o.b. Balt. and Chester in sacks (carloads)	$44.00
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

Ferrochrome

(65-72% *Cr*—2% *max. Si, Lump*)

OPA maximum base contract prices per lb. of contained Cr f.o.b. shipping point with freight allowed to destination.

Numerals are carload prices in bulk, *italic* numerals are l.c.l above 2000 lb., packed.

% Carbon	A	B	C
.03	25.00c.	25.40c.	26.00c.
	26.00c.	*26.65c.*	*27.85c.*
.06	23.00c.	23.40c.	24.00c.
	24.00c.	*24.70c.*	*25.85c.*
.10	22.50c.	22.90c.	23.50c.
	23.50c.	*24.15c.*	*25.35c.*
1.00	20.50c.	20.90c.	21.50c.
	21.50c.	*22.15c.*	*23.35c.*
2.00	19.50c.	19.90c.	20.50c.
	20.50c.	*21.15c.*	*22.35c.*

(A) Eastern Zone. (B) Central Zone. (C) Western Zone. Spot prices are ½c. higher per lb. contained Cr. For extras and premiums see MPR 405.

Ferrosilicon Briquets

OPA maximum base price per lb. of briquet, bulk, f.o.b. shipping point with freight allowed to destination. Approx. 40% Si.

	A	B	C
Car Lots	3.35c.	3.50c.	3.65c.
Less than car lots above 2000 lb.	3.80c.	4.20c.	4.25c.

(A) Eastern Zone. (B) Central Zone. (C) Western Zone. Spot prices ½c. higher per lb. of briquet. For premiums and extras see MPR 405.

Electric Ferrosilicon

OPA maximum base price cents per lb. Si contained, lump size, f.o.b. shipping point with freight allowed to destination. Numerals indicate bulk car lots, *italic* l.c.l. above 2000 lb., packed.

% Si	A	B	C
50	6.65c.	7.10c.	5.25c.
	7.85c.	*9.70c.*	*8.75c.*
75	8.05c.	8.20c.	8.75c.
	9.05c.	*9.65c.*	*13.10c.*

(A) Eastern Zone. (B) Central Zone. (C) Western Zone. Spot sales 45c. for 50% Si; 30c. for 75% Si, per lb. higher. For extras and premiums see MPR 407.

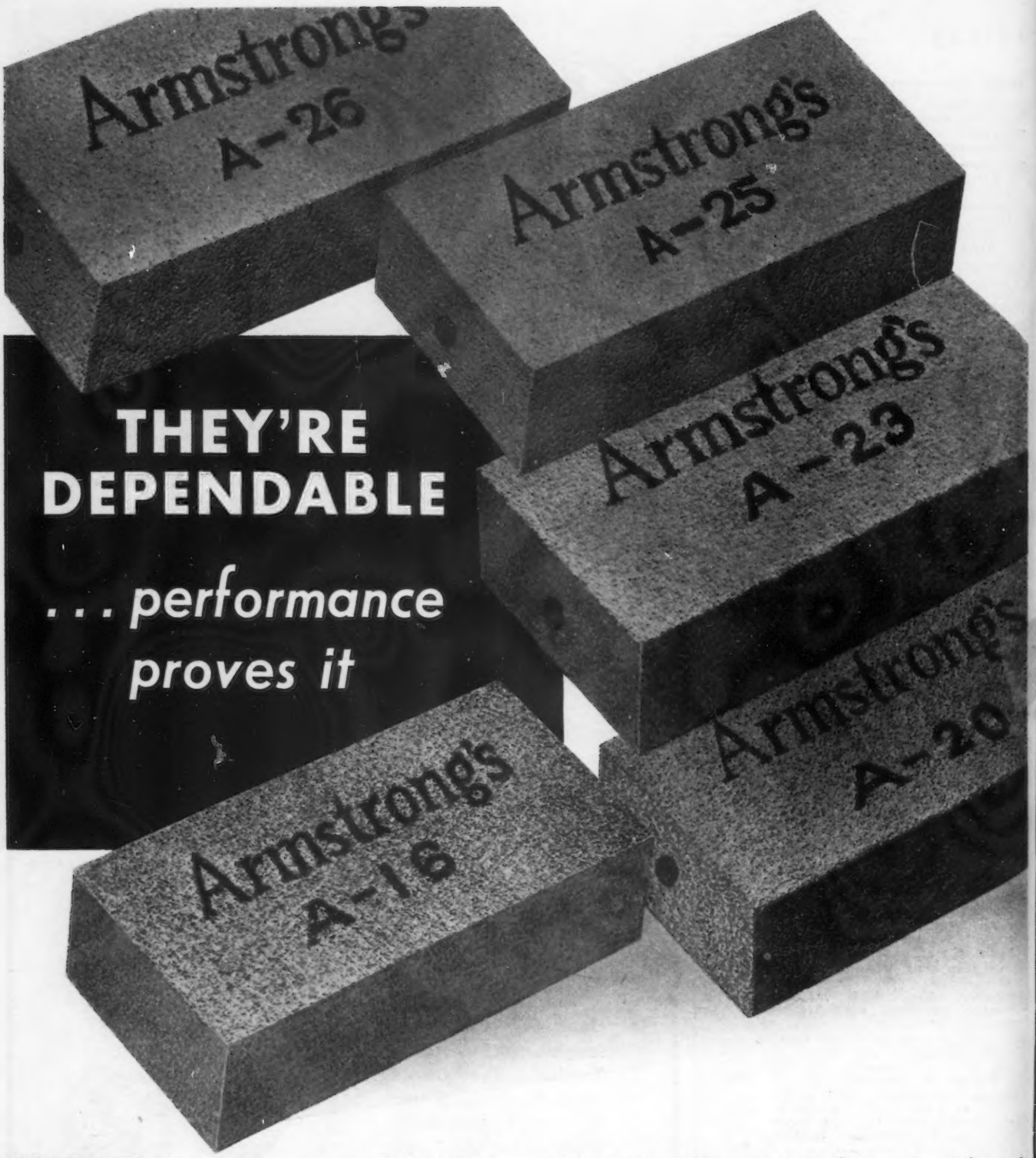
Silicon Metal

OPA maximum base price per lb. of contained Si, lump size, f.o.b. shipping point with freight allowed to destination. Numerals indicate bulk car lots, *italic* numerals l.c.l. above 2000 lb., packed.

Analysis	A	B	C
96% Si, 2% Fe.	12.50c.	12.80c.	13.45c.
	13.10c.	*13.55c.*	*16.50c.*
97% Si, 1% Fe.	12.90c.	13.20c.	13.85c.
	13.45c.	*13.85c.*	*16.75c.*

Other Ferroalloys

Ferrotungsten, delivered, carlots, per lb. contained tungsten	$1.90
Tungsten metal powder, 98%-99%, any quantity, per lb.	$2.60
Ferrovanadium, 35%-40%, contract basis, f.o.b. producers plant, usual freight allowances, open-hearth grade, per lb. contained vanadium	$2.70
Special grade	$2.80
Very special grade	$2.90
Vanadium pentoxide, 88%-92% V_2O_5 technical grade, contract basis, any quantity, per lb. contained V_2O_5	$1.10
Ferroboron, contract basis, 17.50% boron minimum, f.o.b. Niagara Falls, carlots, per lb. alloy	$1.20
Ton lots	$1.25
Silcaz No. 3, contract basis, f.o.b. Niagara Falls, all quantities, per lb. of alloy	23c.
Silvaz No. 3, contract basis, f.o.b. Niagara Falls, all quantities, per lb. of alloy	40c.
Grainal, f.o.b. Bridgeville, Pa., freight allowed 100 lb. and over, maximum based on rate to St. Louis, per lb.	45c.
Bortam, f.o.b. Niagara Falls Ton lots, per lb.	45c.
Less ton lots, per lb.	50c.
Borosil, 3% to 4% boron, 40 to 45% silicon, f.o.b. Philo, Ohio, per pound contained boron	$7.00
Ferrocolumbium, 50% to 60%, f.o.b. Niagara Falls, ton lots, per lb. contained columbium	$2.25
Less-ton lots	$2.30
Ferrotitanium, 40%-45%, f.o.b. Niagara Falls, N. Y., ton lots, per lb. contained titanium	$1.23
Less-ton lots	$1.25
Ferrotitanium, 20%-25%, 0.10 C max., ton lots, per lb. contained titanium	$1.35
Less-ton lots	$1.40
High-carbon ferrotitanium, 15%-20%, 6%-8% carbon, contract basis, f.o.b. Niagara Falls, N. Y., freight allowed East of Mississippi River, North of Baltimore & St. Louis, per gross ton.	$142.50
3%-5% carbon	$157.50
Ferrophosphorus, 18% electric or blast furnace, f.o.b. Anniston, Ala. carlots, with $3 unitage freight equaled with Rockdale, Tenn., per gross ton	$58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Sigio), Tenn., $3 unitage freight equalized with Nashville, per gross ton	$75.00
Ferromolybdenum, 55-75 per cent, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained molybdenum	95c.
Calcium molybdate, 40%-45%, contract basis, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained molybdenum	80c.
Molybdenum oxide briquettes, 48%-52% Mo, f.o.b. Langeloth, Pa., per lb. contained Mo	80c.
Molybdenum oxide, in cans, f.o.b. Langeloth and Washington, Pa., per lb. contained Mo	80c.
Molybdenum powder, 99%, in 200-lb. kegs, f.o.b. York, Pa., per lb.	$2.60
Under 100 lb.	$3.00
Zirconium, 35-40%, contract basis, carloads in bulk or package, per lb. of alloy	15c.
Less-ton lots	16c.
Zirconium, 12-15%, contract basis, carlots, bulk, per gross ton.	$102.50
Packed	$107.50
Less-ton lots	$112.50
Alsifer (approx. 20% Al, 40% Si and 40% Fe), contract basis, f.o.b. Niagara Falls, per lb.	7.50c.
Ton lots	8c.
Simanal (approx. 20% Si, 20% Mn, 20% Al), contract basis, carlots, freight allowed, per lb.	10.50c.
Less-ton lots	11c.



FURNACES all over the country are holding their efficiency . . . keeping up capacity production with the help of Armstrong's Insulating Refractories. These brick are dependable and they're tough. Many years of service have proved that they can stand up under peak loads.

Five types of Armstrong's Insulating Fire Brick—for temperatures from 1600° F. to 2600° F.—are available to help you do a complete and efficient furnace engineering job.

All five brick bar heat loss. They aid in accurate heat control and thus insure uniform, high quality production. Every Armstrong Brick, though light in weight, is highly resistant to spalling, has exceptional crushing strength (hot and cold), and ample *refractoriness* for the use intended.

Armstrong engineers, with a background of 28 years' experience in the use of lightweight refractories, will be glad to help you solve your furnace problems. For full information, write today to Armstrong Cork Company, Insulating Refractories Department, 4906 Concord St., Lancaster, Pa.

ARMSTRONG'S INSULATING REFRACTORIES

ELECTRIC FERRET

You are looking down a cylinder barrel for a 2000-h.p. aircraft engine.

Here you see the rough-machined forging. When the engine builder gets through with this forging it will be finished to precise dimensions, smooth and bright as a mirror, and extremely hard.

Such a transformation takes time and money. If the last strokes of the polishing machine should uncover injurious imperfections on the smooth inner walls of the barrel, that time and money would be wasted.

To prevent spoilage and rejections *after* machining, Bethlehem gives all Aircraft Quality steel routine representative Magnaflux tests —first when the steel is still in billet form and later (in the case of cylinder barrels) when these rough-machined forgings are ready to ship to the customer.

In principle, Magnaflux is quite simple. The sample is magnetized in a bath of light oil and iron powder, then removed and examined. Hidden flaws are instantly revealed, as the iron powder clings tightly to the surface of the steel directly above any imperfection, indicating its shape, severity, and approximate depth beneath the surface.

The Magnaflux is one of many tests applied by Bethlehem to Aircraft Quality steel. We produce steel for cylinder barrels, connecting rods, gears, cams, and bearings, as well as for dozens of other important aircraft-engine applications. Bethlehem Aircraft Quality Steels are fighting over Europe and the Mediterranean, and over the Pacific.

BETHLEHEM STEEL

THE IRON AGE, published every Thursday by the *CHILTON CO. (INC.)*. Entered as second class matter November 8, 1932, at the Post Office at Philadelphia under act of March 3, 1879. $8 yearly in North America and South America, Foreign $15. Vol. 151, No. 25.

Miles Up . . .
THAT'S PRECISION

As enemy aircraft approach and the ack, ack opens up, a tiny flaw in any mechanism might mean "target missed."

By *borizing* many important gun components to extremely close tolerances—often to .0002"—Heald Bore-Matics help put precision in anti-aircraft guns that gets specks 5 miles up. And because *borizing* assures constant duplication of accuracy, part after part matches identically.

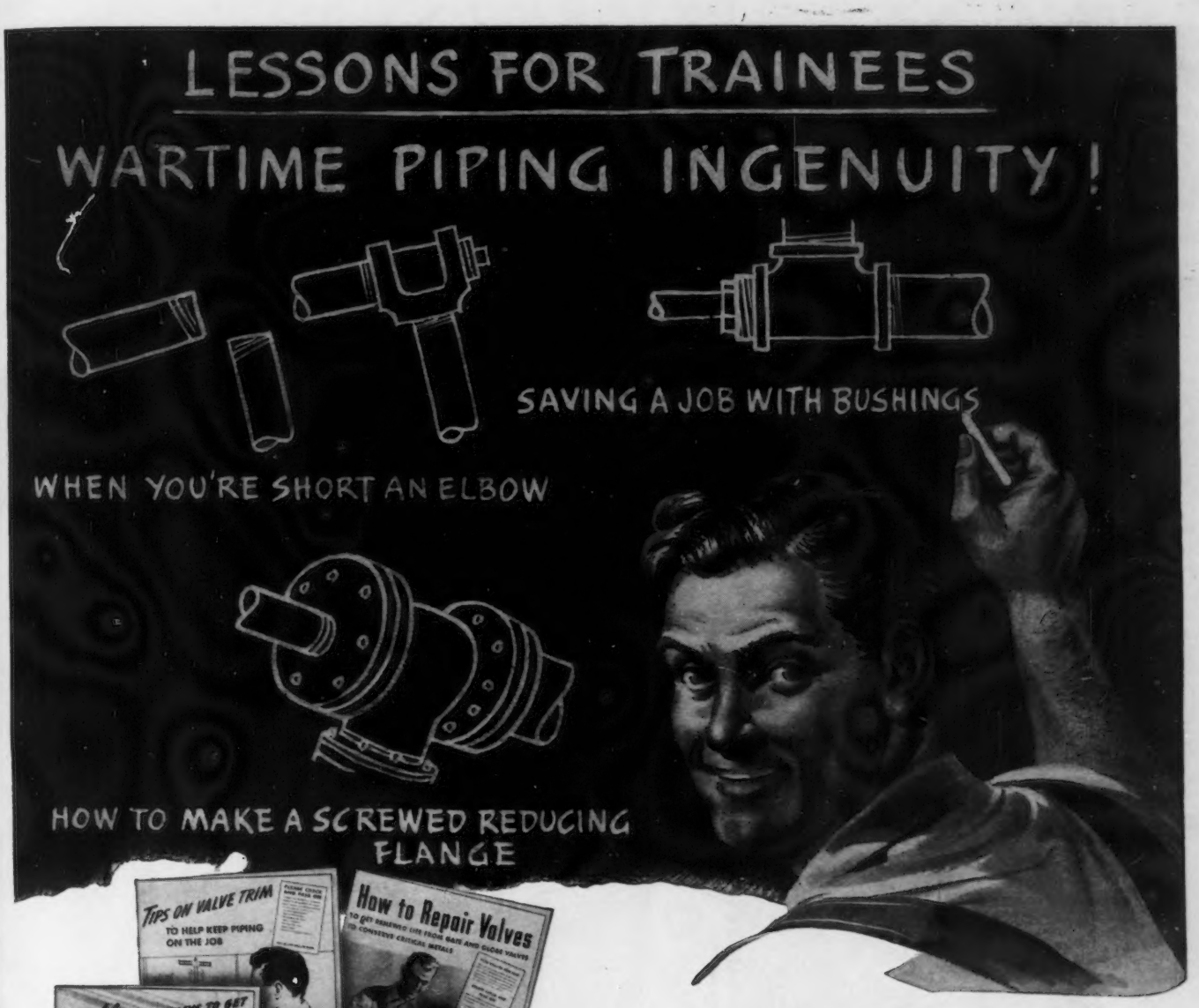
It's no secret how Heald Bore-Matics get their extreme accuracy. It's simply the same Heald know-how in precision engineering that has made Heald Boring Machines and Heald Grinding Machines the answer in leading industries demanding close tolerances, high-speed production and cost reduction.

Heald Engineers are always ready to help you with your precision boring and grinding jobs. Ask for their services. They'll help you step up production through specially designed tooling and fixtures . . . specially designed for your Heald and for your own particular requirements.

Borizing a casing for Bofors 50 mm anti-aircraft guns. First operation bores two 3.375" diameter holes spaced 4.125" apart using a cross slide of indexing. Then work is indexed 90° and two holes 1.500" are bored in line by means of opposed heads.

The HEALD MACHINE CO.
WORCESTER, MASS. U.S.A.

FOR MORE PRECISION *FASTER*
BRING YOUR PROBLEMS TO HEALD



Ask for as many sets as you can use. First come, first served.

"Piping Pointers" Give the Answers

On the ingenuity of piping men depends the flow of our fighting supplies. How to get pipe lines installed and keep them working right despite material shortages is what today's piping trainees must learn quickly.

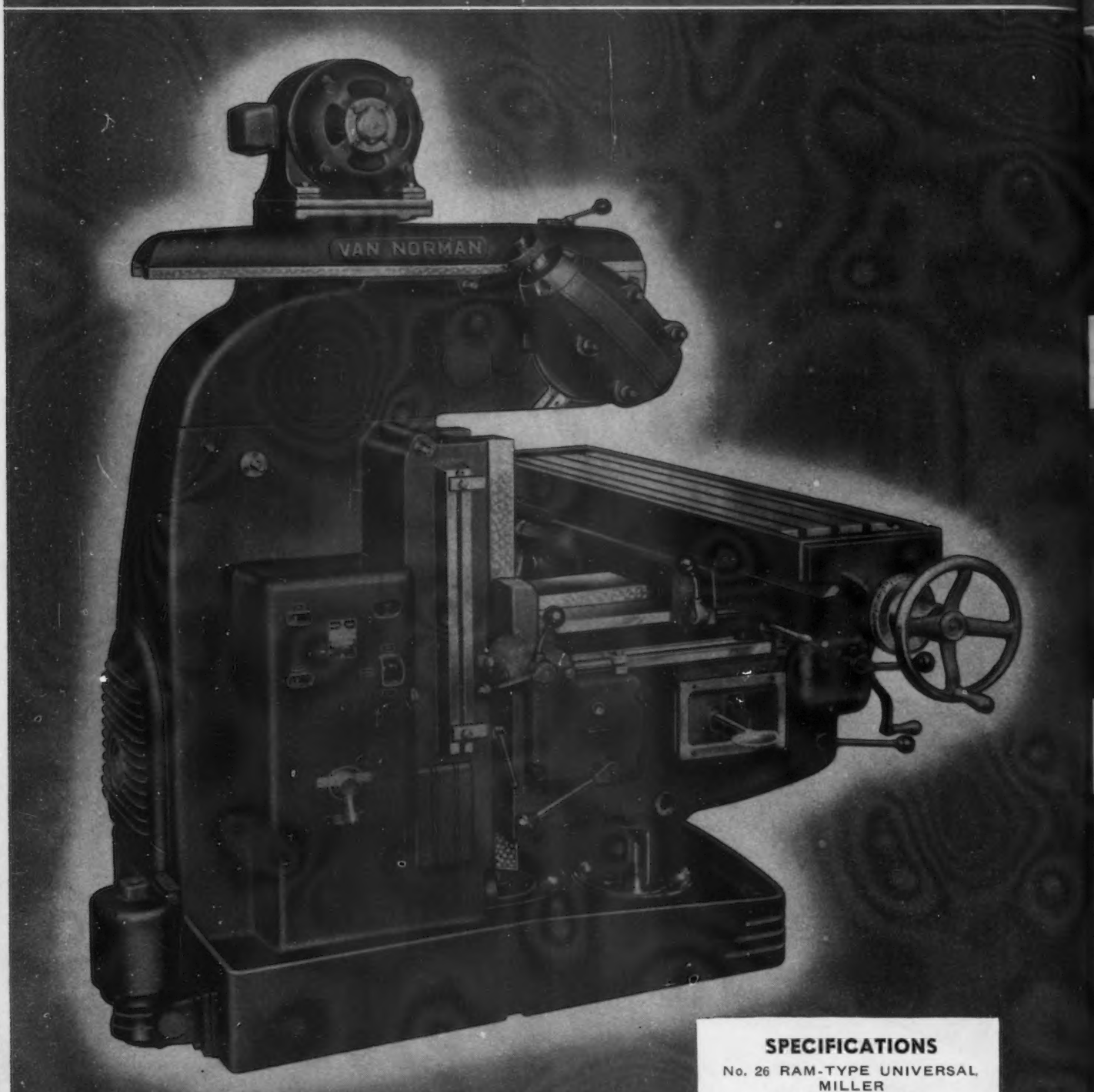
For your trainees, there's valuable help in Bulletin 6 of the "Piping Pointers" series—a Crane service aiding hundreds of plants in better wartime maintenance. Examples of the hints it gives—short cuts to faster piping jobs—practical suggestions on substitutions for critical materials—are shown above.

FREE ON REQUEST—**As the leading maker of valves and fittings, Crane Co. gladly shares the basic information on which "Piping Pointers" are founded, to help all industry get better service from piping equipment. Copies of Bulletin 6 and others supplied free by asking your Crane Representative, or by writing to: Crane Co., General Offices, 836 South Michigan Avenue, Chicago, Illinois.**

ARMY E NAVY

CRANE VALVES

HORIZONTAL ··· *ANGULAR*

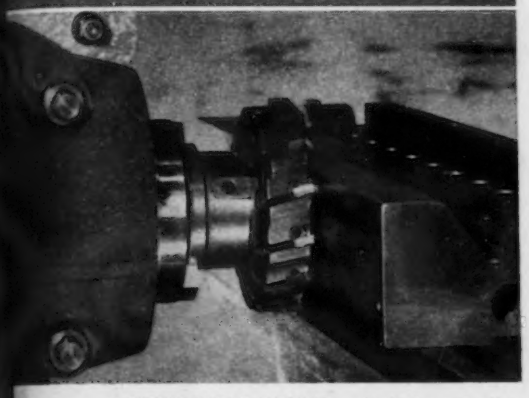


SPECIFICATIONS

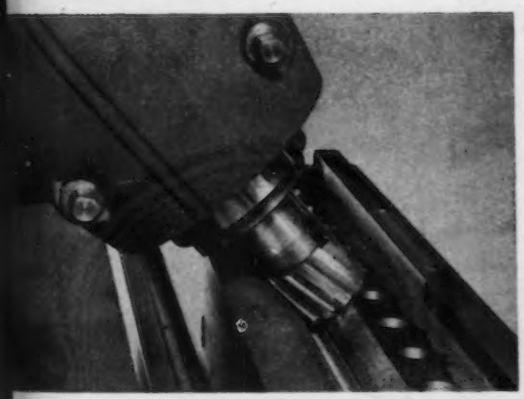
No. 26 RAM-TYPE UNIVERSAL MILLER
Table: 50" x 12"
Range: 28" longitudinal, 12" cross, 18" vertical
18 feeds: 30 to 1500 rpm
18 feeds: 3/8" to 32"

VERTICAL MILLING

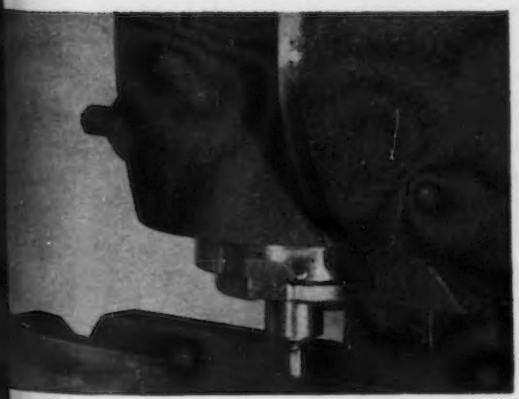
ON VAN NORMAN RAM-TYPE UNIVERSAL MILLING MACHINES



HORIZONTAL MILLING... lock the swiveling cutterhead in the horizontal position... insert the cutting tool... set-up the work and you're ready for the cut.



ANGULAR MILLING... swing and clamp the cutterhead at the desired angle and proceed with the operation. No need to change the set-up of the work piece.



VERTICAL MILLING... leaving the work still in the original set-up, you set the cutterhead in the vertical position and finish the milling operation. One work set-up enables you to carry most jobs through to completion.

***Minimizes Work Reset-ups**

***Improves Work Accuracy**

***Eliminates the Need of Moving Work from One Machine to Another**

So versatile are the applications of the Van Norman Ram-Type Universal Milling Machine that it fits well into the war production scheme of every plant.

By simply changing the position of the adjustable cutterhead, you can do precision horizontal . . . angular . . . or vertical milling all on this one Van Norman machine. Because the work stays fixed in the original set-up, many errors that often creep up when the work piece is changed are eliminated. In addition, valuable men and machine hours are saved because the necessity of transferring the work from one type of milling machine to another is eliminated.

Add to the above advantages . . . simplified directional front and rear controls of all power feeds . . . large, easy-to-read dials . . . solid rigidity . . . accuracy and you'll readily see why an operator with this Van Norman miller can turn out more work faster . . . in a shorter time . . . with less rejects.

ARMY E NAVY

VAN NORMAN MACHINE TOOL COMPANY

SPRINGFIELD, MASSACHUSETTS

Today's *Production Miracles* forecast the advantages Steel's fabricability can give your future products

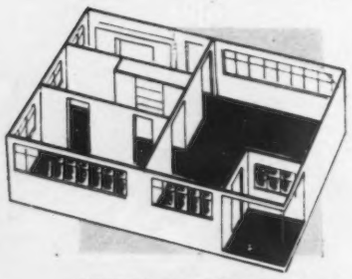
DID you think of prefabrication as something new, born of this war? Actually, United States Steel applied prefab successfully to shipbuilding 25 years ago! But now these same shipyards have advanced so far in perfecting their fabricating and construction techniques that it takes only one-third the time to build a destroyer that it did a few short years ago. That's *fast* for a 1600-ton warship . . . and one big reason it's so fast is that steel and prefab go together as naturally as Gilbert and Sullivan!

Any successful prefab design calls for materials that can be shaped and assembled quickly, economically and permanently; handled and shipped conveniently; and effectively protected against deterioration. Steel usually is the best answer. What other material has steel's high strength-weight ratio, plus its ability to be cut, formed, welded, riveted, soldered, machined, stamped and finished?

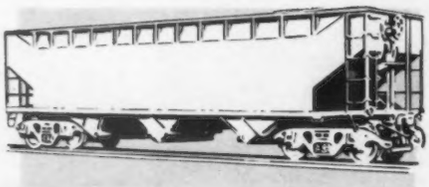
Wartime performance . . . a new standard of value for selection of materials

When you read about the amazing combat resistance of a heavy bomber — the smooth, deadly precision of a new aerial torpedo—or the powerful surge of compact naval turbines . . . just stop a moment and think of the materials that make such performance possible. You'll find steel playing the feature role in every theatre of action . . . and playing it with the characteristic versatility that keeps steel *forever new.*

The same superior properties that give U·S·S Steels their fighting effectiveness today will be ready tomorrow to make your future products outstanding in performance and marketability.



PREFABRICATED ARCHITECTURAL UNITS, such as windows, cabinets, stairways, closets—even complete bathrooms and kitchens—offer an exciting and profitable field for postwar design. The full range of U·S·S Steels gives you a free hand to design whatever manufacturing and service qualities you choose into products for tomorrow's homes.



PREFAB RAILROAD CARS, both freight and passenger, will be a logical answer to the pent-up equipment needs of war-weary rail systems when peace returns. Improved car designs will take full advantage of U·S·S low-alloy high tensile steels to provide economical fabrication, light construction for greater payload, and lower maintenance.

THESE U·S·S STEELS offer one of your most complete sources of design inspiration:

U·S·S HIGH TENSILE STEELS to resist corrosion and increase strength without adding weight.

U·S·S COPPER STEELS to give twice the atmospheric corrosion resistance of regular steel at little additional cost.

U·S·S HOT-ROLLED AND COLD-ROLLED STEELS to provide the basic advantages of steel, plus maximum economy in accordance with the needs of each job.

U·S·S ABRASION-RESISTING STEEL to combat wear and friction.

U·S·S STAINLESS AND HEAT-RESISTING STEELS to assure high resistance to corrosion and heat, and to reduce weight.

U·S·S CARILLOY ALLOY STEELS—Special steels for the special jobs of industry.

U·S·S PAINTBOND—A galvanized, Bonderized sheet that permits immediate painting and holds paint tighter.

U·S·S VITRENAMEL—Sheets designed especially for porcelain enameling.

U·S·S ELECTRICAL SHEETS for motors, generators and transformers.

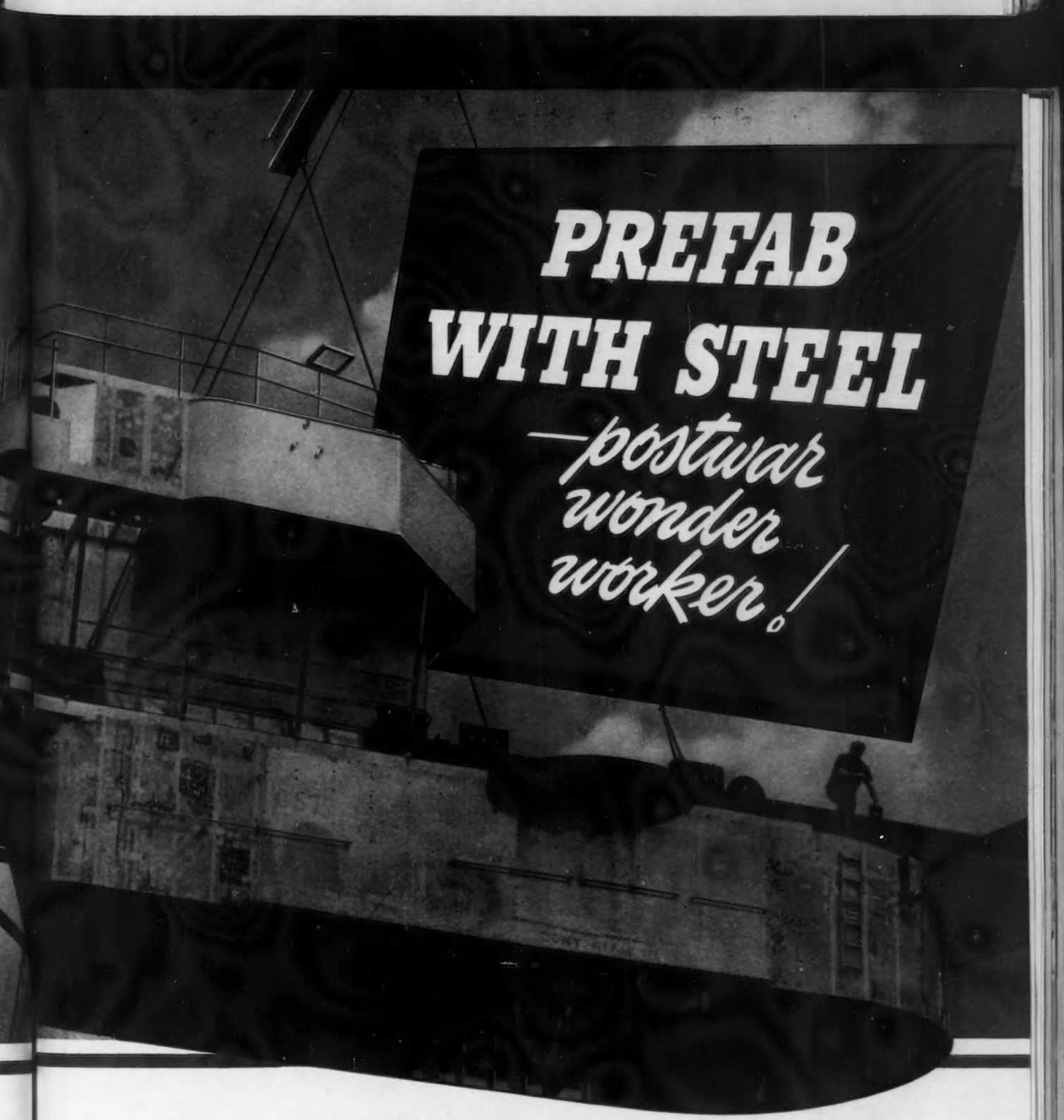
USS

ONLY STEEL CAN DO SO MANY JOBS SO WELL

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Supply Company, Chicago, *Warehouse Distributors* · United States Steel Export Company, New York



What will your "Designs for Tomorrow" need to make them successful?

ABSOLUTE SANITATION . . . *like this?*

Military hospitals use a wide variety of equipment made of porcelain enamel on U·S·S VITRENAMEL Sheets—an ideal material where utter cleanliness and bright appearance are important. The ductile steel base forms and fabricates easily, and the hard, inorganic enamel surface gives lasting protection against stains and corrosion. Here's the material for tomorrow's home appliances, store fixtures, food and chemical plant equipment, prefabricated kitchens and bathrooms.

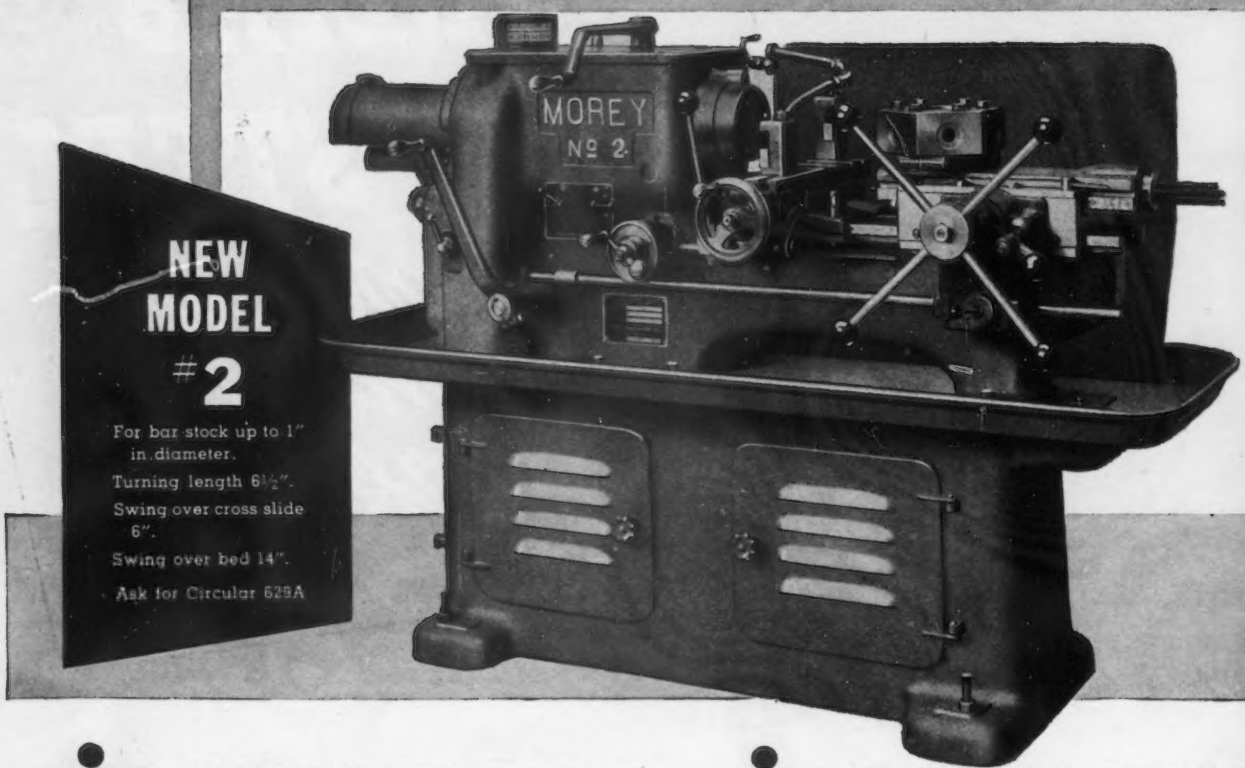
HIGH ENDURANCE . . . *like this?*

The qualities that count in an Army truck or transport unit are stamina, loading capacity, and downright dependability. That's why so many of them have frames of U·S·S COR-TEN High Tensile Steel. COR-TEN has a yield point 1½ times that of structural steel; more than 3 times the stress resistance of non-ferrous "light" metal; and over 4 times the atmospheric corrosion resistance of ordinary steel. Would these qualities help *your* equipment meet the challenge of a post-war world?

ONE AIM . . VICTORY . . *BUY BONDS!*

UNITED STATES STEEL

MOREY TURRET LATHES for



NEW MODEL #2

For bar stock up to 1" in diameter.
Turning length 6½".
Swing over cross slide 6".
Swing over bed 14".
Ask for Circular 629A

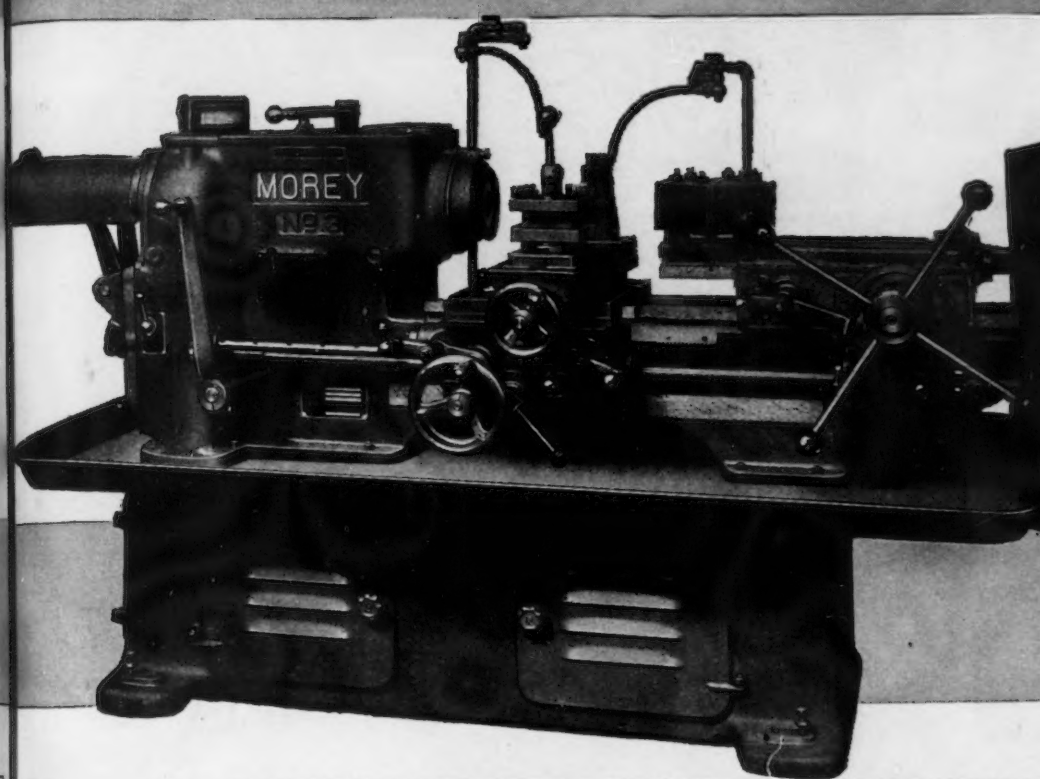
- INFINITE SPINDLE SPEEDS – Electrically Selected—Minimum of 60 RPM.
  Maximum of 2000 RPM.
  Constant horsepower at all speeds.
- DIRECT BELT DRIVE AVAILABLE AT HIGH SPEEDS ELIMINATES GEAR MARKS (patents applied for).
- GEARED SPINDLE SPEEDS INSTANTLY AVAILABLE THROUGH MULTIPLE DISC CLUTCHES.
  SPINDLE MOUNTED ON TIMKEN BEARINGS.
- RIGID—WITH SUFFICIENT POWER TO TURN AT THE HIGHEST SPEEDS AND FEEDS *MODERN* TOOLS WILL WITHSTAND
- SPINDLE SPEEDS AND POWER FEED CHANGES WITHIN EASY REACH OF OPERATOR.
- BED MOUNTED ON CABINET BASE.
- MOTORS AND STARTING EQUIPMENT EASILY ACCESSIBLE.
- HEXAGON TURRET AUTOMATICALLY UNCLAMPED, INDEXED AND CLAMPED.
- THREE TYPES OF CROSS SLIDES AVAILABLE:
  Lever Feed
  Screw Feed
  Combination Feed*
- *Combination feed provides instantaneous selection to either lever or screw feed.
- EIGHT (8) FEED CHANGES FOR THE UNIVERSAL CARRIAGE and HEXAGON TURRET, INSTANTLY ENGAGED OR DISENGAGED BY ONE MOVEMENT OF THE LEVER.

"EARLY DELIVERY"

MOREY

410 BROOME STREET

for BAR or CHUCKING { UNIVERSAL and PLAIN



#3 UNIVERSAL

For bar stock up to 1½" in diameter.

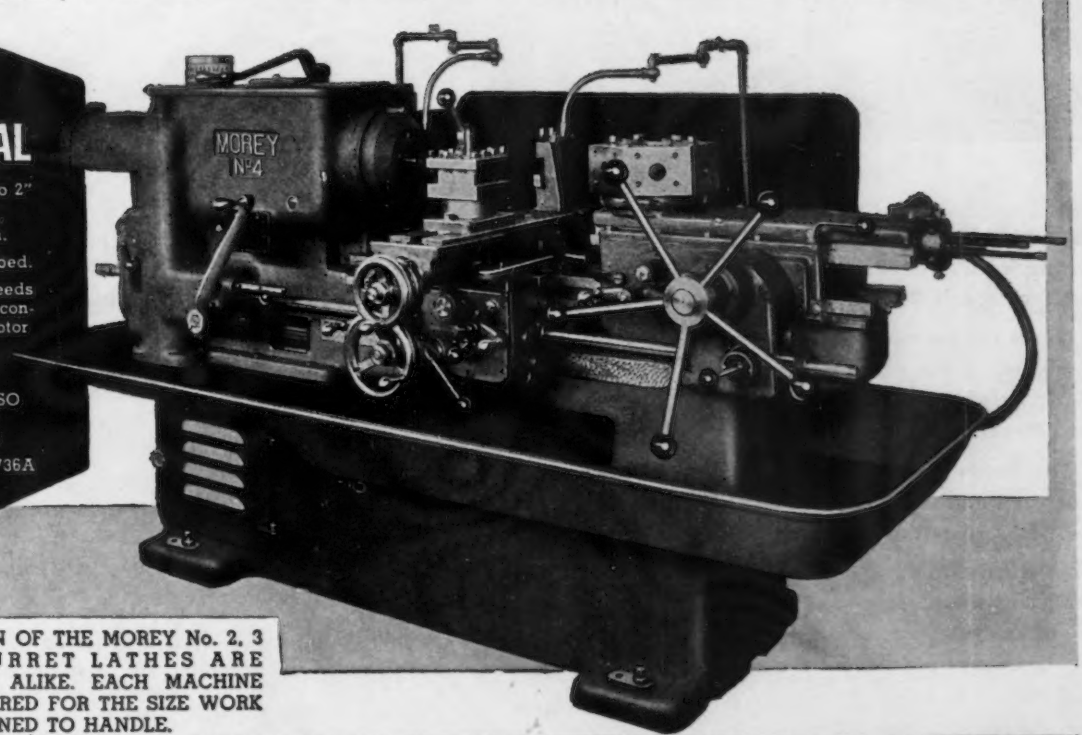
10" turning length.

16½" swing over bed.

Infinite spindle speeds 55 to 1800 RPM, constant speed motor, 1200 RPM.

AVAILABLE ALSO WITH PLAIN CROSS SLIDE

Ask for Circular 727A



#4 UNIVERSAL

For bar stock up to 2" in diameter.

12" turning length.

19½" swing over bed.

Infinite spindle speeds 35 to 1500 RPM, constant speed motor 1200 RPM.

AVAILABLE ALSO WITH PLAIN CROSS SLIDE

Ask for Circular 736A

THE DESIGN OF THE MOREY No. 2, 3 and 4 TURRET LATHES ARE BASICALLY ALIKE. EACH MACHINE IS ENGINEERED FOR THE SIZE WORK IT IS DESIGNED TO HANDLE.

MACHINERY CO., INC

NEW YORK, N. Y. *Plant* 4-57 26TH AVE., ASTORIA • NEW YORK

STRONG ARM OF THE FLEET

Because heavy seas, time or other factors do not always permit launching seaplanes by lowering them over the side of the vessel, catapults are often used on cruisers, carriers and other craft. These devices eliminate take-off runs.

TO THROW an airplane into the air takes a mighty strong arm. Launching these eyes of the fleet from a cruiser deck is the job of the catapult.

Gears on the catapult must be rugged to stand the punishing shock that comes when the speed of the airplane weighing more than two tons is increased from 0 to 70 miles per hour in a distance of 60 feet!

The gears in the engines powering these planes must be tough, too. For though light in weight, their job is to transmit the power of 2000 horses to whirling propeller blades.

Making these gears—the rugged ones for the launching devices and the marvels of high precision for the airplane engines—is Foote Bros.' job, and Foote Bros. are proud of the service that the gears they make are rendering—proud of the manufacturing know-hows, the advancements in techniques that have been developed to produce these gears in the tremendous quantities needed for an America at war.

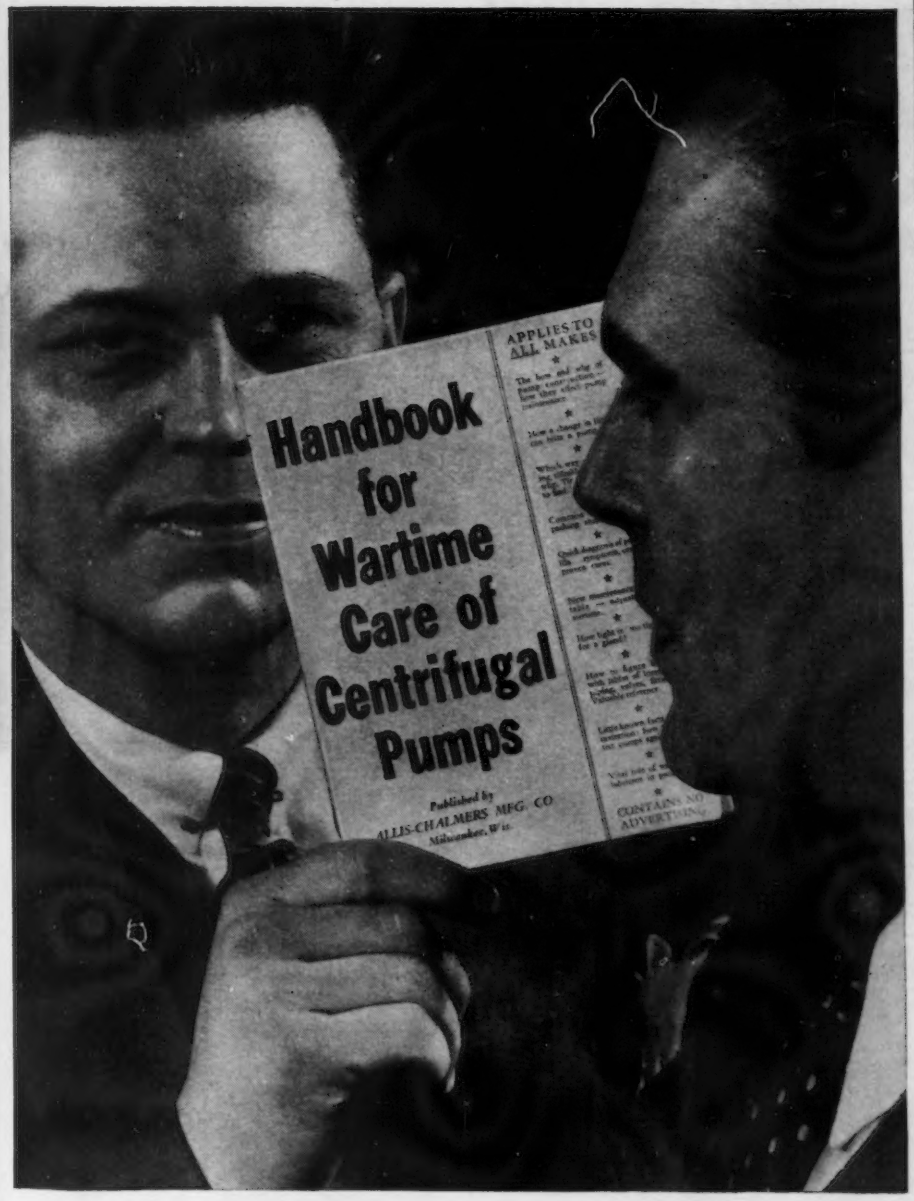
But more important to American Industry is what these manufacturing know-hows will mean to peacetime production. For experience gained today in producing gears that are tougher—gears that possess a higher degree of precision—gears that demand the latest manufacturing technique will assure more economical power transmission—more efficient machines for American Industry when the war is won.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago, Illinois

FOOTE BROS.

Better Power Transmission Through Better Gears

Pump Book Makes News!



Contains no advertising— applies to all makes — copies mailed free of charge. Use it to make present pumps last. And when you *do* need new pumps, look into the extra efficiency, ruggedness and long life of Allis-Chalmers centrifugal pumps — the famous "Electrifugal" . . . and all types for every purpose.

ALLIS-CHALMERS
MILWAUKEE

WE WORK FOR VICTORY — WE PLAN FOR PEACE

HOW TO MAKE EQUIPMENT WORKING ROUND THE CLOCK LAST IS INDUSTRY'S MOST DISCUSSED SUBJECT. MOST DISCUSSED BOOK IS A-C'S NEW PUMP MAINTENANCE GUIDE!

NOW THAT PUMPS are working 2 and 3 times as many hours a week as in peacetime, *they need wartime care* . . . the kind set forth in Allis-Chalmers new "Handbook for Wartime Care of Centrifugal Pumps"!


We contain and direct the spinning liquid with a casing...

By building a pump on paper, this new handbook takes a *fresh* look at pump anatomy. Contents include new preventive maintenance tips, a guide to spotting trouble, a new *war* timetable for pump care, valuable tables. Tear out the coupon below and send in now for *your* free copy!

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* a copy of your "Handbook for Wartime Care of Centrifugal Pumps".

(Name)

(Title)

(Company)

(Street Address)

(City and State)

A-1582—6

A 100% RECORD

Awards on May 8th, 1943 to two plants in Kenosha, Wisc., completed this 100% record for The American Brass Company.

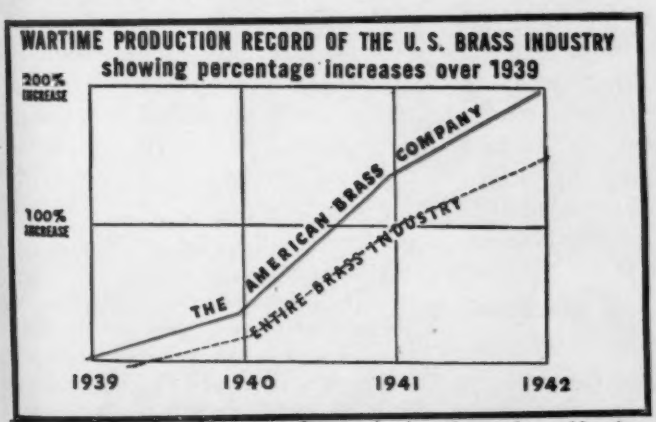
ALL TEN AMERICAN BRASS CO. PLANTS IN U. S. A. HAVE EARNED RIGHT TO FLY ARMY-NAVY "E" FLAGS

This is the story in terms of war production

Our Connecticut plants were among the first in the brass industry to receive the coveted "E" Award for outstanding production of war materials. Since then *all* our plants, including those in the States of Michigan, Wisconsin and New York, have been similarly honored.

As the largest fabricator in the copper and brass field, The American Brass Company is keenly aware of its responsibility and its opportunity to serve the cause of the United Nations.

Since 1939, production has been tripled, with virtually every pound today going for war purposes.



This chart*, based on 1939 peacetime production, shows the rapid swing into all-out war production, both by the copper and brass fabricating industry and The American Brass Company (not including Government-owned plants). All-time production records have been continually broken ever since the National Defense Program was initiated in 1940.

*Based on compilations of The American Bureau of Metal Statistics

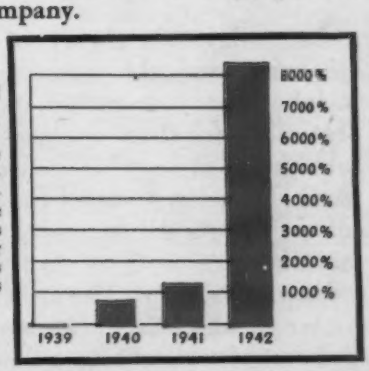
This record was accomplished by close cooperation between management and labor . . . careful planning for rapid conversion to wartime operations . . . intensive training of new personnel . . . plus efficient utilization of existing and new plant equipment.

Detailed figures, of course, cannot be revealed, but The American Brass Company is consistently breaking all previous volume records. In addition to its U. S. plants and that of a Canadian subsidiary, Anaconda American Brass Ltd., the company's production also embraces three plants operated for the United States and Canadian Governments.

Shipments this past January were the largest in the company's history. March exceeded January. The first quarter of '43 was by far the greatest tonnage quarter in the records of the company.

PRODUCTION OF COPPER ALLOYS FOR AMMUNITION by The American Brass Co.

This chart shows the vast increase in production of copper-base alloys directly earmarked for ammunition in plants operated by The American Brass Company. This is one of the most vital needs for copper and brass. Tremendous quantities are required for all types of ammunition.



The American Brass Company is proud indeed that all the plants it operates in the U. S. A. have won the honor of flying the Army-Navy "E" for excellence in production. But it is even prouder of the organization and the will-to-produce that have made this record possible . . . *and will keep it going.*

43184C

THE AMERICAN BRASS COMPANY

ANACONDA

Subsidiary of *Anaconda Copper Mining Company*

BUY ALL THE BONDS YOU CAN AFFORD . . . TURN IN ALL THE SCRAP YOU CAN FIND

A Few Products of QUAKER CHEMICAL RESEARCH:

New type cutting fluids to replace oils on all machining operations.

•

Wax, grease and oil-type corrosion resisting coatings.

•

Products for cleaning and rustproofing in one operation.

•

Water soluble solvents to replace degreasers and alkaline baths for metal cleaning.

•

Modern emulsoid solutions for grinding.

•

Compounds for drawing, stamping and forming of all metals.

•

Special chemicals and oils for every metal processing operation.

Quaker Chemical puts the EMPHASIS ON RESEARCH

Develops products and processes to overcome problems heretofore inadequately handled

MORE THAN a decade ago, we at Quaker Chemical dedicated our organization to the task of locating processing problems in industry which we felt have never been handled quite satisfactorily . . . and to developing chemical products and processes that would overcome past troubles.

So, today, the heart of the Quaker Chemical organization is its laboratory—or, rather, its laboratories—for there are *two* separate "labs" at our Conshohocken plant. One, the Control Laboratory, inspects all incoming raw materials as well as our own finished products. The other, a corner of which is shown above, is devoted entirely to research and development.

Heading these two "labs" is an eminent scientist who has studied at four leading universities, both here and abroad, and who has personally been granted more than 40 practical patents.

The Research group comprises more than 25 chemists and engineers . . . most of whom have accompanied Quaker Process Engineers on their field service calls and are, therefore, familiar with metal processing and are able to envisage the practical side of every shop problem. Their work —which consists of both special problems and permanent projects directed toward basic research in corrosion, cutting, drawing and similar propositions—is carried on in a large, modern, open laboratory where every individual knows the work of the others.

In addition to the work of this group, Quaker Chemical also maintains fellowships and sponsors research projects in five leading universities.

Probably no other similar manufacturing organization devotes so large a proportion of its facilities and energies to research. That this policy has borne fruit is evidenced by the many new type Quaker Chemical products that have already won wide acceptance throughout industry.

Just how far-reaching will be the effect of some of these developments on metal processing remains to be seen. In some cases their performance has been truly outstanding . . .

But rather than make extravagant claims for these products, we prefer to use this method of inviting you to establish contact with us . . . so that your plant may share immediately in whatever benefits emerge from Quaker's never-ending research.

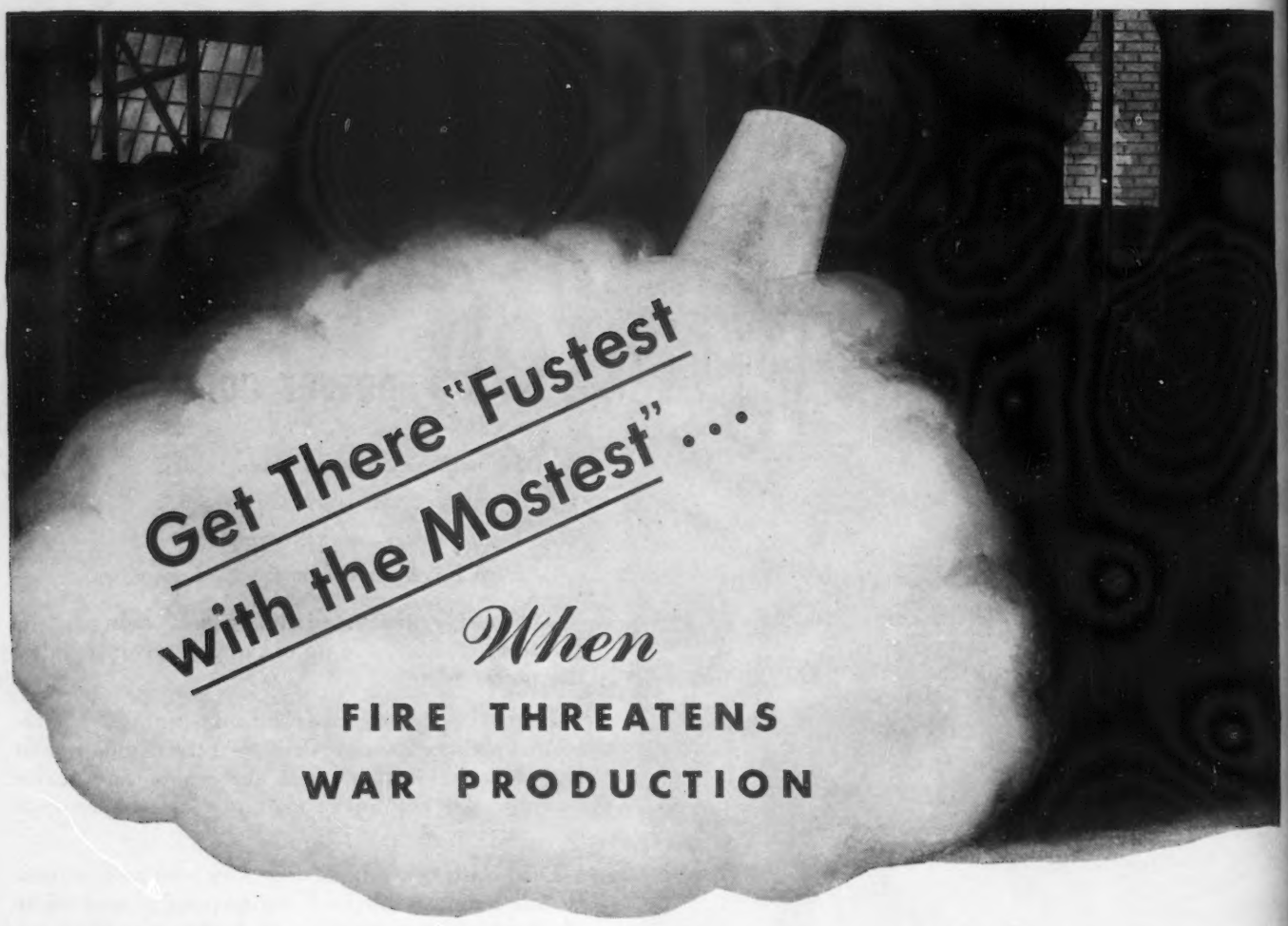
A Quaker Process Engineer will gladly call and discuss with you just where our new developments may fit into your metal working picture. Simply write or wire—

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

OTHER PLANTS IN CHICAGO AND DETROIT

WAREHOUSE STOCKS IN PRINCIPAL INDUSTRIAL CENTERS



Winning the "*Battle of Production*" involves a lot more than a supremacy of materials, machinery and manpower. One major fire . . . or a small fire that results in crippling damage by the extinguishing medium . . . can halt or slow down war production in a dozen vital plants.

Cardox Fire Extinguishing Systems are guarding against these crippling fires in plants producing a wide variety of critical war products. For example, individually engineered applications are on duty in important plants producing such military necessities as:

Airplanes, Aviation Engines, Aviation Carburetors, Airplane Parts, Engine Parts, Plastics, Rubber Products, Processed Fabric, Tanks, Tank Engines, Cold Strip Steel, Armor Plate, Forgings, Solvents, Motor Fuel, Electric Power.

By instant smothering of fire and cooling of combustibles through the mass discharge . . . at high rate of flow . . . of low pressure, low temperature CO_2, Cardox Systems provide the all-important advantage of fast, complete extinguishment of large or small fires—without damage by the extinguishing medium.

Today, Cardox is concentrating its engineering and manufacturing facilities on two basic activities: (1) Designing and manufacturing of Cardox Fire Extinguishing Systems needed to make it possible for the Armed Forces of America to have more planes, guns, tanks and ammunition; (2) working with industry on plans to increase the efficiency of fire protection both today and after the war.

If you would like more information, write on company letterhead for Bulletin 763.

CARDOX CORPORATION
BELL BUILDING • CHICAGO, ILLINOIS

District Offices in New York • Washington
Detroit • Cleveland • Atlanta • Pittsburgh
San Francisco • Los Angeles • Seattle

★ *BUY WAR BONDS* ★

How Cardox Systems Protect War Industries

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

MASS DISCHARGE OF CO_2 · ENHANCED COOLING EFFECT · CENTRAL STORAGE UNIT · AMPLE CO_2 RESERVE · ENGINEERED SYSTEMS · MANUAL OR AUTOMATIC CONTROL

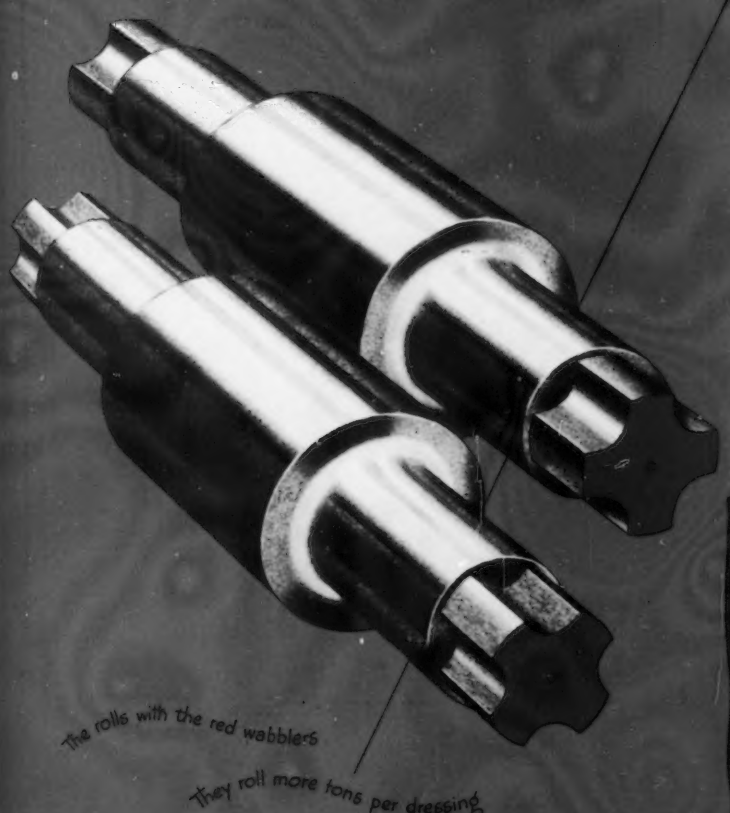
CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

Ol' Red Wabbler says:

Hytensite Rolls have the strength of steel...

The wearing and finishing properties of cast iron

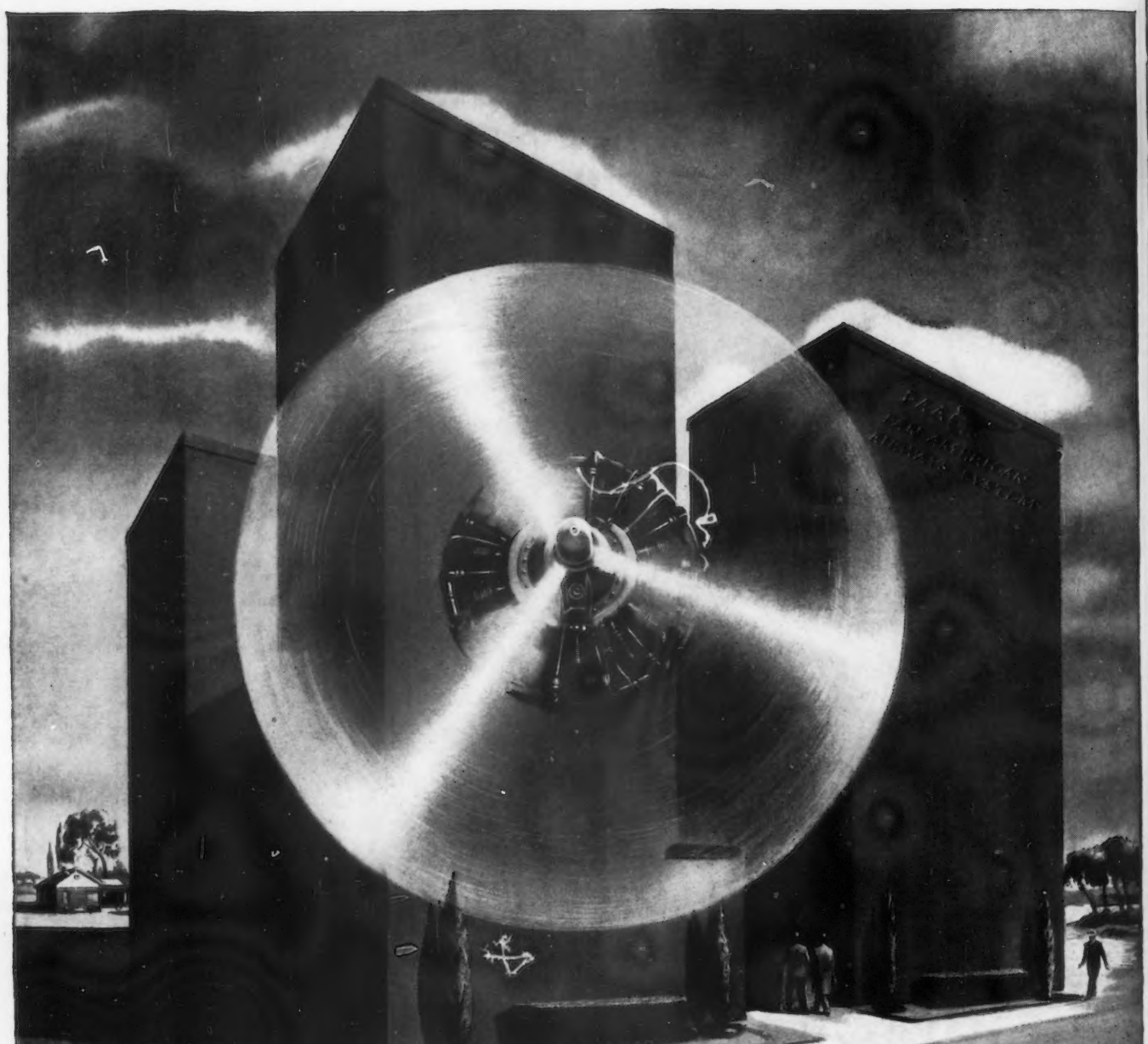


The M-H Hytensite Rolls are high test alloy cast iron, specially treated. They contain appreciable proportions of visible graphite finely and uniformly distributed throughout, with a corresponding uniformity of structure of wearing and finishing qualities. They have a tensile strength of 60,000 to 100,000 lbs. per sq. in., with hardness of 50 to 70 Scl. (C scale). They are cast iron, and as such are free from the deleterious "notch effect" of steel. Small radii in the neck fillets and various passes, do not adversely weaken the roll.

You can have these extra qualities built into Mackintosh-Hemphill rolls — specify M-H Hytensite Rolls on your next order for finishing stands of Merchant Mills, Sheet Bars and Billet Mills.

Other Mackintosh-Hemphill Products: Rolling Machinery . . . Shape Straighteners . . . Strip Coilers . . . Shears . . . Levellers . . . Pinions . . . Special Equipment . . . Iron-Steel Castings . . . The NEW Abramsen Straightener . . . Improved Johnston Patented Corrugated Cinder Pots and Supports . . . Heavy Duty Engine Lathes.

MACKINTOSH-HEMPHILL COMPANY—Pittsburgh and Midland, Pa.



Cave-of-the-Winds in Miami

Inside this unique building, the engines of Pan American Clippers are put through their paces. Propellers roar with the thunder of 4000 horsepower —creating super-hurricanes as air is pulled down one set of stacks and pushed out through the other set.

Outside, there's hardly a sound—for in each stack a honeycombed unit of cells soaks up the resonance, bit by bit, until it is finally dissipated.

Naturally, this completely windowless test house had to be air conditioned—to remove heat generated by the engines, to provide controlled testing temperatures, to make working conditions bearable for the engineers. As in so many other exacting applications of air conditioning and industrial refrigeration, the equipment selected was General Electric.

Today, G-E air conditioning and refrigeration engineers are devoting all their talents to problems of war production and testing. They are learning much that will lead to better, more economical manufacturing methods—to healthier, happier living—when we return to the pursuits of peace.

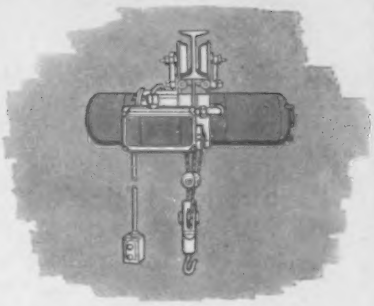
Air Conditioning and Commercial Refrigeration Department, Division 437, General Electric Company, Bloomfield, New Jersey.

Air Conditioning by

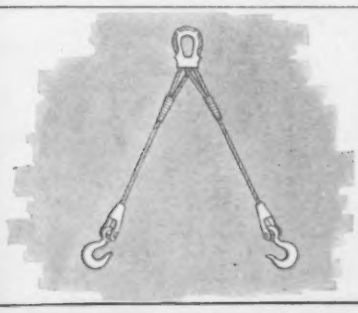
GENERAL ELECTRIC

Salient POINTS IN CMP Re: Buying Wire Rope

WHEN BUYING WIRE ROPE FOR INCLUSION IN A PRODUCT YOU ARE MAKING,



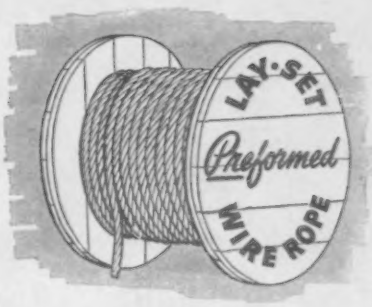
REMEMBER: Wire rope is a Controlled Material • Your orders should bear the abbreviated allotment numbers—such as: W-8-20 • Preference ratings on orders bearing allotment numbers are valueless. Wire rope producers are required to fill authorized controlled materials orders without regard to preference ratings • The allotment number on a wire rope order must show the actual month of delivery and *not* the quarter in which delivery is required.



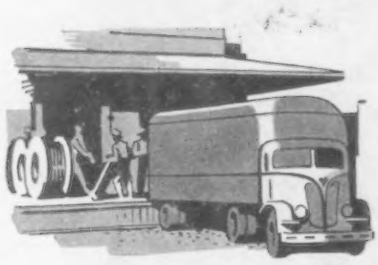
WHEN BUYING WIRE ROPE ASSEMBLIES,

REMEMBER: Assemblies consisting of wire rope and fittings are Class B if they are air-borne, but Class A if they are not • If Class A, you must furnish us with an allotment of the steel required for the wire rope, and for the fittings if they are also class A • If Class B, you must not furnish an allotment of steel for either the fittings or the rope • In either case, your orders must bear allotment numbers or they cannot be considered delivery orders for products containing controlled material.

WHEN BUYING WIRE ROPE FOR MAINTENANCE, REPAIRS, OR OPERATING SUPPLIES,



REMEMBER: Subject to the limitations imposed upon you by any "P" order under which you may be required to operate, and provided you produce a product or are engaged in any business in Schedules I or II of CMP Reg. 5, the symbol MRO on a wire rope order, followed by any appropriate certification, makes your order an authorized controlled material order, and • A preference rating is not required, because wire rope is a controlled material • Just be sure to observe the quantity restrictions stated in Par. (f), CMP Reg. 5.



WHEN BUYING WIRE ROPE IN SMALL QUANTITIES FROM WAREHOUSES,

REMEMBER: You don't need an allotment number or a preference rating for wire rope if • 1—You order in amounts of $10 or less, • or 2—If you don't buy more than 4,000 pounds per calendar quarter, or • 3—If you are authorized to buy it under Food Production Order 3 • Just be certain that you don't exceed the inventory limitations stated in CMP Reg. 2 • Certify your orders as stated in CMP Reg. 4.

HAZARD WIRE ROPE DIVISION • Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Fort Worth, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Portland, Tacoma

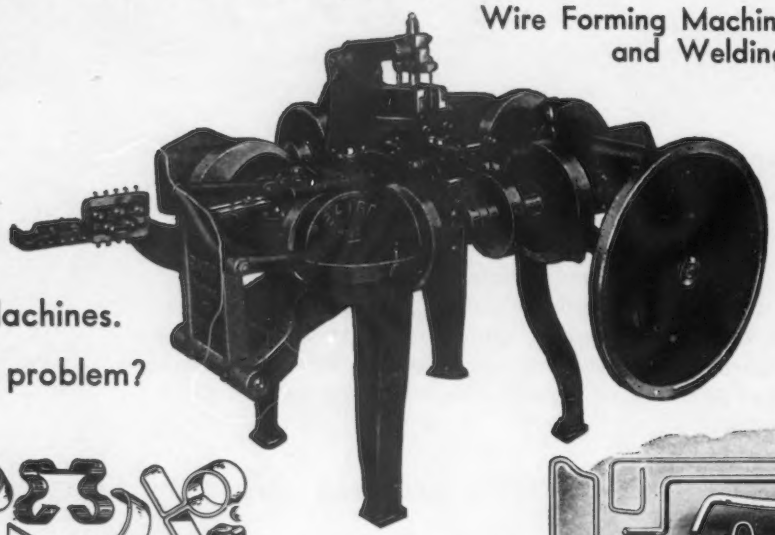
AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONNECTICUT (May 20, 1943)

HAZARD LAY·SET *Preformed* WIRE ROPE

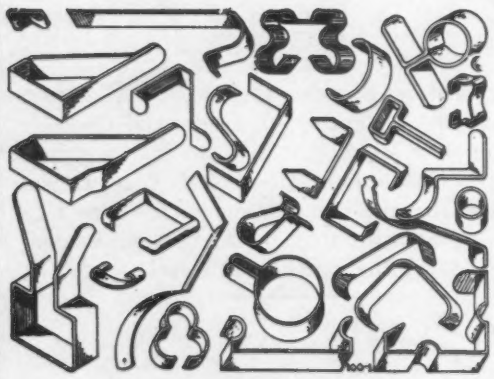
BAIRD PRODUCTION MACHINES

Reduce costs of goods, enabling more people to buy and the increased demand makes more work and more jobs mining and rolling metal or drawing wire, etc., from which to make the goods.

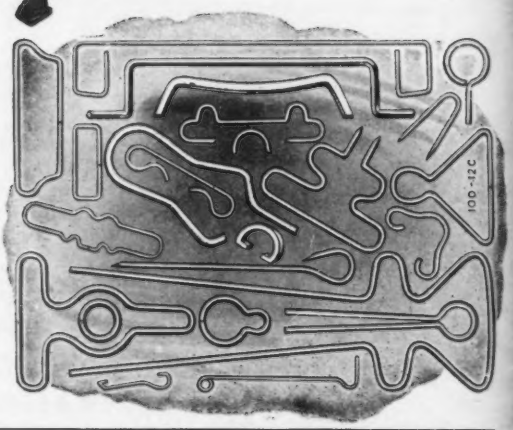
Ribbon Metal Forming Machines. Special High Production Machines. What is your problem?

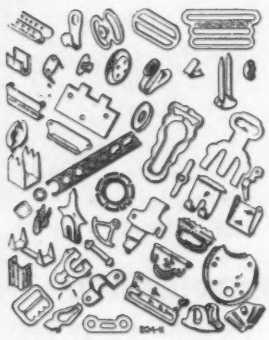


Wire Forming Machines. Wire Forming and Welding Machines. Machines to make chain clips, fasteners, pins, hinges, hangers, buttons, buckles, thumb - tacks, bails, hairpins, safety pins, springs, etc.



The articles shown opposite illustrate some forms made on BAIRD Four Slide Wire and Ribbon Metal Forming Machines as shown above.

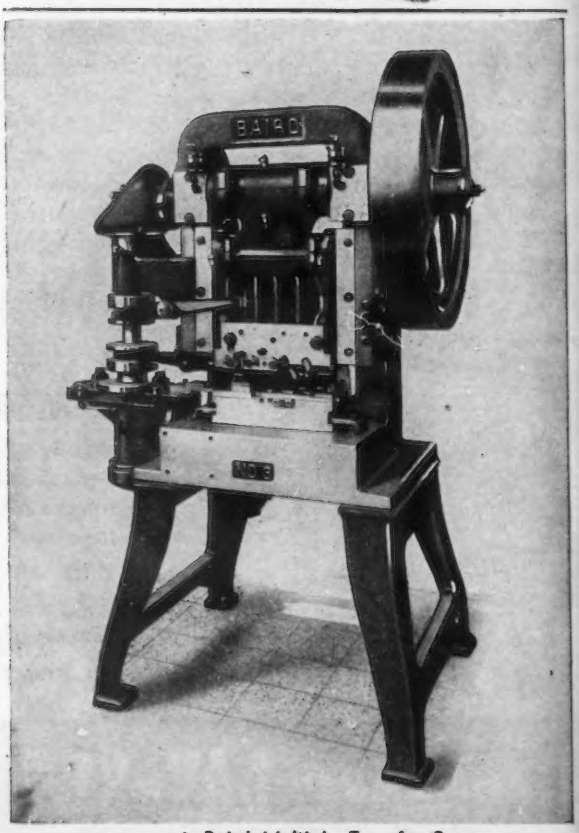




Foot Presses
Automatic Open Back Presses
" Pillar Presses
" Single Transfer Presses
" Multiple Transfer Presses
" Tandem Presses
" Special Presses
" Machinery Since 1846

"Ask BAIRD About It"

THE BAIRD MACHINE CO.
STRATFORD, CONNECTICUT



A Baird Multiple Transfer Press

Prevent Corrosion & Pitting

AFTER YOU'VE DECIDED to use Gargoyle BRB Greases for ball bearings you can go back to getting out production and be assured *that* problem is solved.

These greases do not break down and form the deposits which lead to corrosion and pitting.

In fact, their reliable stability allows bearings to go through periods of a year or more without repacking.

In addition, these greases do not change in structure within wide temperature ranges.

Here are greases you can *depend* on! This has been proved in thousands of applications under operating conditions.

You've solved an important operating problem when you let the Socony-Vacuum man who calls on you specify Gargoyle BRB Greases for the ball bearings in your plant.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM

"700% INCREASE IN PRODUCTION"

You'll see why we use quotation marks for our title when you read the following written report on *stoning* cutting tools after grinding:

> *"I remember one job where we were testing cut-off blades made of various types of steel and could find but approximately 20% difference in production with the tools made of the different steels. However, when we stoned the cutting edges of an 18-4-1 steel tool, a 700% increase in production resulted, with improved finish on the part."*

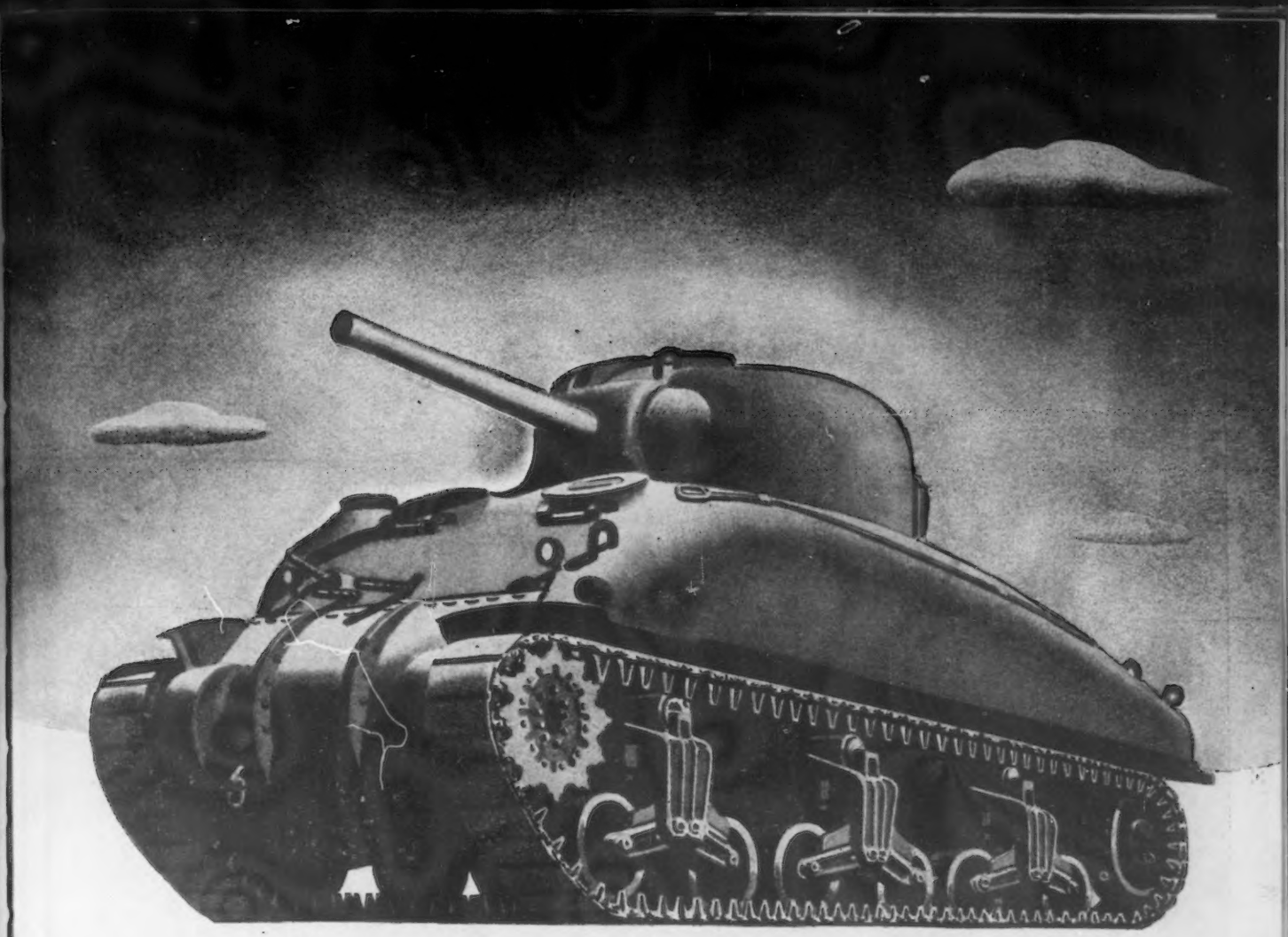
When you consider that these are the words of the engineer in charge of small tools in one of the most famous airplane engine plants; that in this specific case he was not primarily interested in what "stoning" would do, but was testing the effectiveness of various tool steels, we believe you will feel bound to investigate how much attention *you* now pay to getting greater and better output *by stoning the edges of all your cutting tools.*

We've a branch nearby and will be only too glad to make recommendations and trials from among the hundreds of shapes and sizes in our **INDIA** and **HARD ARKANSAS** oilstones.

▲

The stones he used were: INDIA Round Edge Slip, followed by one of HARD ARKANSAS, for supreme finish. (See illustration.)

BEHR-MANNING • TROY, N. Y.
(DIVISION OF NORTON COMPANY)
Also Reliable Coated Abrasives Since 1872



TO YOU it looks like a tank, but to us it is reminiscent of a dredge pump casing . . . or a locomotive frame . . . or a bank vault . . . or an annealing box . . . or any other tough and enduring industrial casting made by Union Steel.

★ ★ ★

The tank is reminiscent of these things, because these are the things we used to make before Uncle Sam became our Class "A" customer, and Army and Navy ordnance armor our major product.

★ ★ ★

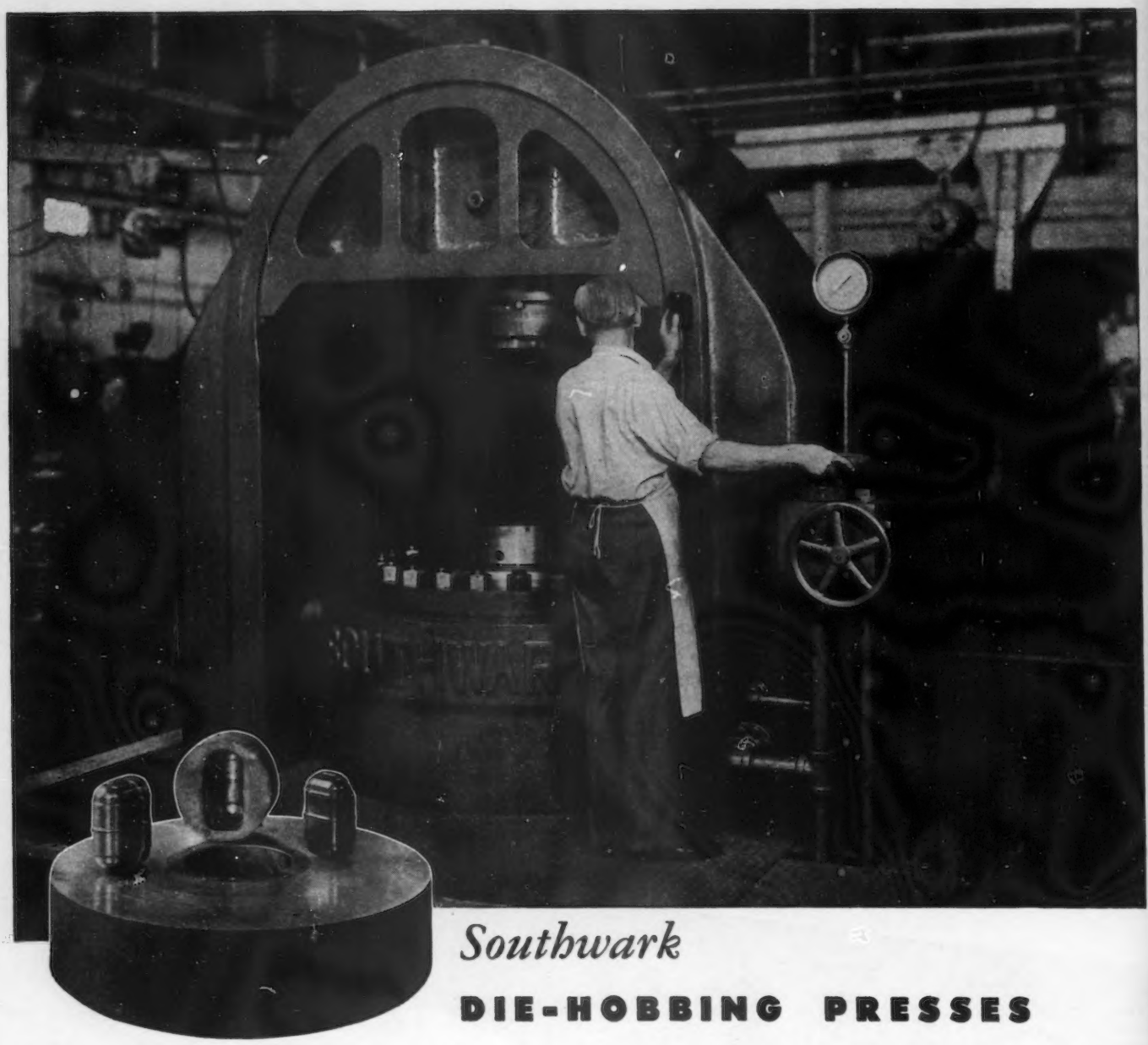
But, while our production effort here at Union is mainly concentrated on the war, we are thinking hard about what is coming after. It may be that our post-war planning could be of help to you—in making castings that fit Tomorrow's bewildering needs.

UNION STEEL CASTINGS

DIVISION OF BLAW-KNOX COMPANY
• PITTSBURGH, PENNSYLVANIA

MAKERS OF:

Driving wheel centers, locomotive frames, pump casings, vault doors and frames, annealing boxes, spindles, coupling boxes, open hearth charging boxes, gear blanks—and other steel and alloy castings for steel mills and general industry.



Southwark

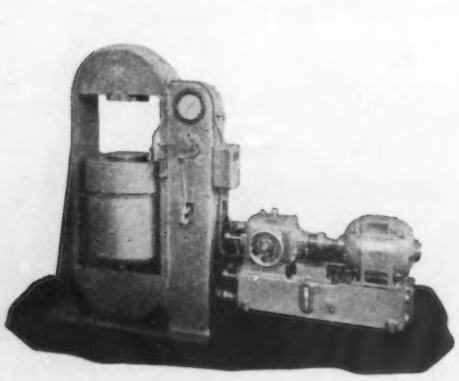
DIE-HOBBING PRESSES

Close control, smoothness in power application and rugged dependability are built-in features of Southwark hydraulic presses. These qualities are indispensable for accurate die-hobbing.

Sound design, good materials and honest workmanship are part of every Southwark press. Southwark's years of press building experience are paying real dividends in whatever industry they are used now that uninterrupted production is all-important.

When you're planning new plant equipment for the competition of tomorrow it will pay you to specify Southwark. Write for Bulletin M-160.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco.

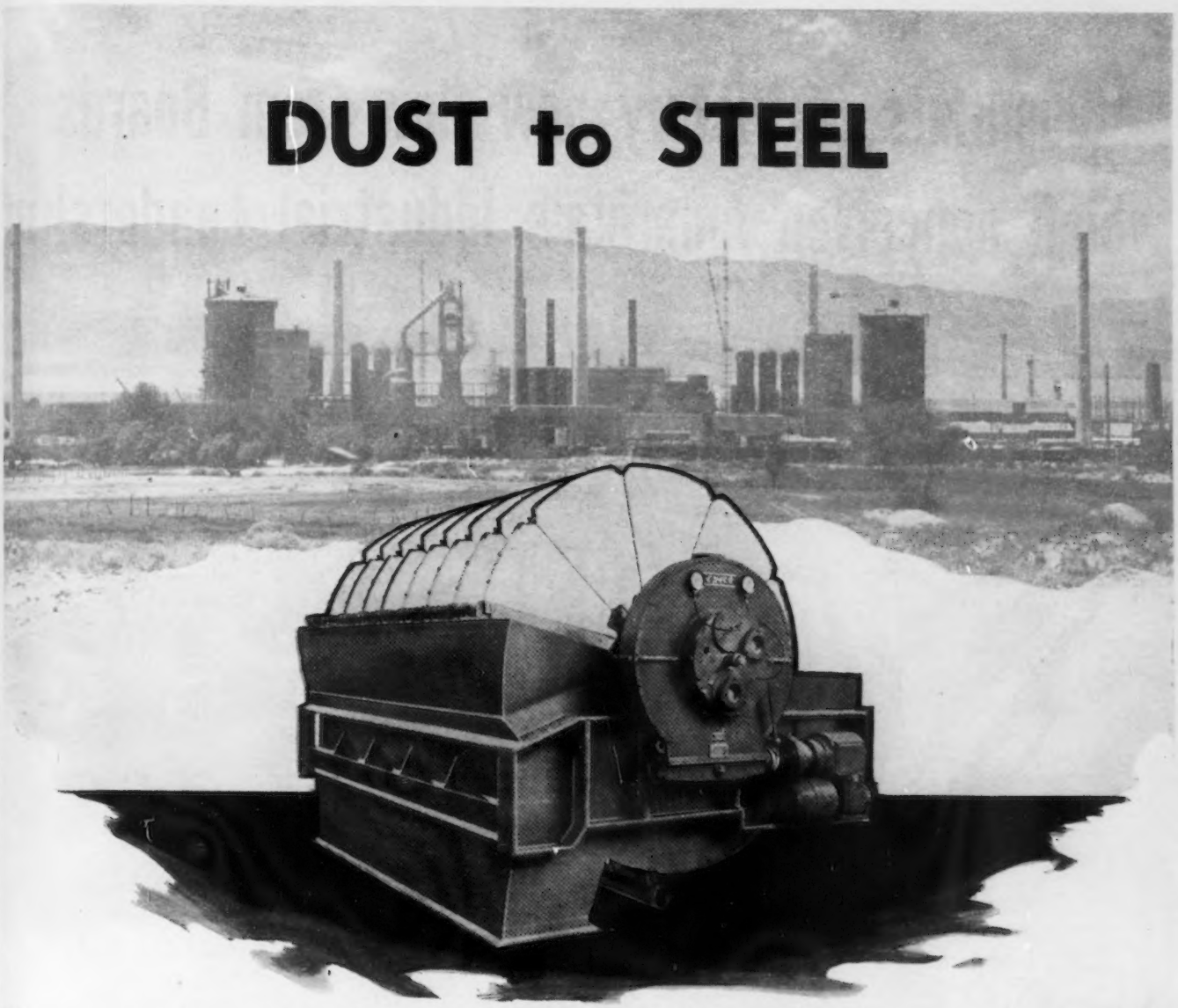


BLW THE BALDWIN GROUP

BALDWIN SOUTHWARK

Division THE BALDWIN LOCOMOTIVE WORKS, *Philadelphia, Pa.*

DUST to STEEL



Newest, most modern Steel Plant Installs Eimco Disc Filter

Rising on the shores of Utah Lake in the heart of the Rocky Mountains is America's newest and most modern steel plant. Silouetted against the western sky like a mirage is this miracle, a tribute to the ingenuity, skill and genius of our wizards of industry. It incorporates the final "know-all" in blast-furnace, coke oven, open-hearth, and steel mill design—in its making have been put the sum-total of experience and craftsmanship. Unlimited funds were made available by the Defense Plant Corporation so that only the best in equipment and facilities were used.

Recovery of Blast Furnace Flue Dust was one of the requisites essential to the efficient operation of the huge blast furnaces. The choice of experts and procurement agents when it came to the continuous vacuum filter for dewatering blast furnace flue dust was an EIMCO Disc Filter.

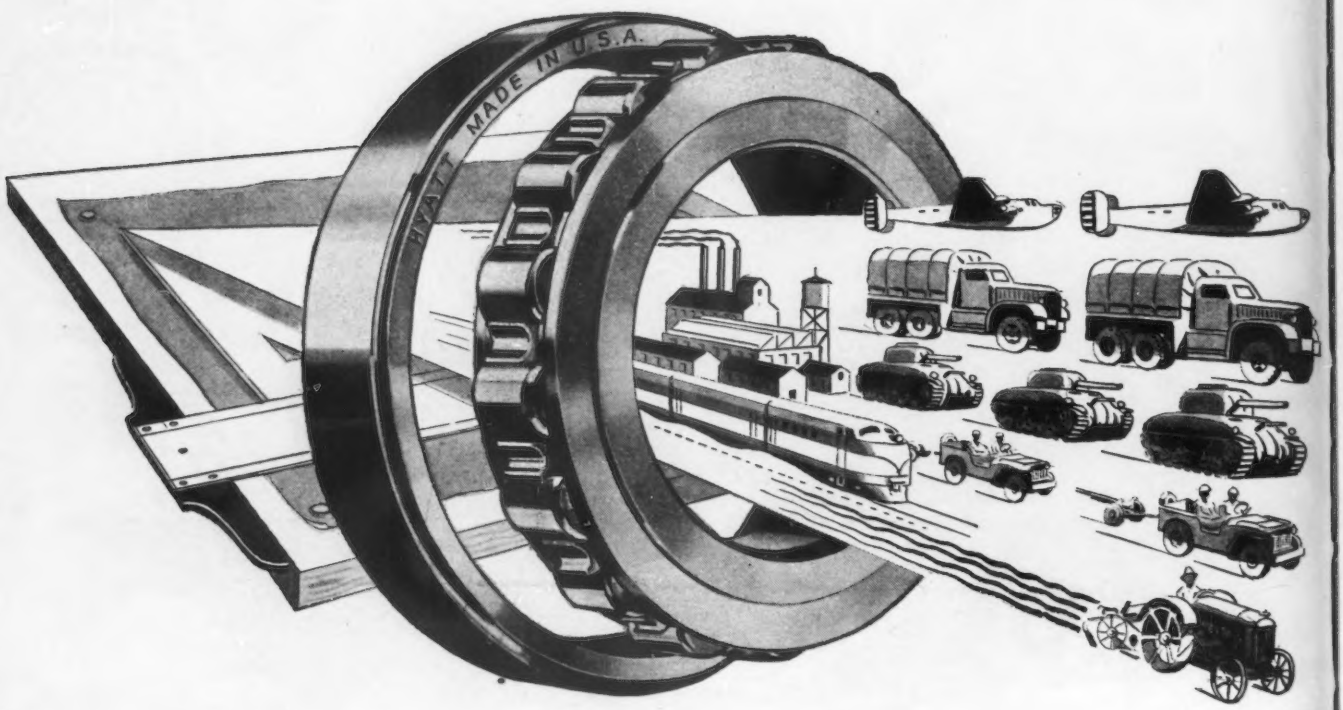
EIMCO Disc Filters have recently been specified by numerous steel plants where the importance of recovering Blast Furnace Flue Dust has become a factor. EIMCO filtration engineers are available and anxious to consult and cooperate with prospective users.

THE EIMCO CORPORATION

SALT LAKE CITY, UTAH, U.S.A.

NEW YORK	CHICAGO	EL PASO	SACRAMENTO
120 Broadway	111 W. Washington St.	Mills Bldg.	1217 7th St.

Blueprints of Victory now flow from Boards which conceived America's Industrial Leadership



To design engineers, accustomed to overcoming mechanical obstacles in their stride, the Axis was just another problem for them to lick.

So they reached into their bag of tricks...the old American "know-how"...and came up with a thousand nightmares for the Axis dream.

And in designing these mighty weapons they naturally called on one of their chief stocks in trade—dependable Hyatt Roller Bearings, to help them in the job.

For that reason, you'll find Hyatt Roller Bearings built into the tools of fighting as well as farming, into tanks as well as trucks, into ships as well as machine shops, into warplanes as well as war workers' cars... carrying on their uninterrupted fight against friction and wear, making possible better design and, of course, the better performance which goes with it.

Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

HYATT ROLLER BEARINGS

NEW TOTALLY ENCLOSED TRI-CLAD MOTOR

FULLY ARMORED AGAINST THE ENTRY OF DESTRUCTIVE MATERIALS—RESISTANT TO CORROSION AND EXTERNAL DAMAGE

On this new member of the Tri-Clad motor family, end shields and frame are solid cast iron, smoothly contoured and tightly fitted. Ball bearings are protected by a rotating-labyrinth bearing seal—against damaging dusts or liquids. The leads are sealed in compound in a cast-iron pocket in the frame. Inside, the motor has all the extra-protection features of Tri-Clad open motors, such as Formex* wire.

An outstanding feature of these new motors is that their mounting dimensions are interchangeable with those of open motors of like rating.

For complete information on the totally enclosed Tri-Clad, see your G-E representative, or write to General Electric Co., Schenectady, N. Y.

*Reg. U.S. Pat. Office

FRAME SIZES

Hp	Rpm	Poly-phase	Single-phase
1/2	900	204	
3/4	1200	203	204
3/4	900	224	
1	1800	203	203
1	1200	204	
1	900	225	
1 1/2	3600	203	203
1 1/2	1800	204	204
1 1/2	1200	224	
2	3600	204	204
2	1800	224	

FOR "CRUEL" SERVICE CONDITIONS LIKE THESE

(Meeting requirements of WPB Motor Conservation Order L-221)

DESTRUCTIVE DUSTS*

Where rock dust, metal filings, powdered chemicals, or other finely divided materials are present in destructive quantities.

CORROSIVE FUMES*

Where motors are exposed to corrosive acids and alkalies in liquid or vapor form, such as on mixers in chemical pilot plants.

GUMMY, VISCOUS MATERIALS

In working with paints, oils, syrups, and other materials which might "gum up" the interior of an open motor.

SUPERSATURATED ATMOSPHERES

Where motors must operate without fail in areas filled with steam, water vapor, oil droplets. Also out of doors in humid, stormy climates.

* In addition to this *standard* totally enclosed Tri-Clad motor, G. E. can furnish *explosion-proof* types, tested and listed by Underwriters' Laboratories, Inc., for (1) hazardous dusts, such as magnesium dust, coal dust, grain dust, (2) hazardous fumes, such as gasoline.

GENERAL ELECTRIC

Reproduced from a full-color painting by Douglass Crockwell for Republic Steel.

"Vote for That Guy? Not on Your Life!"

"This war's made me think how important it is to use your head when you vote. Once, they could vote in Germany—but they got careless. Now they just say 'Ja'—or else. Knowing who you're voting for is the best way to keep little would-be Hitlers from getting in the driver's seat over here!"

★ ★ ★

Our right to vote secretly and without fear of reprisal is one of our most precious rights as *FREE* Americans. It gives us the power to protect *at home* the very freedoms for which we are waging war.

FREE American business, *FREE* labor and *FREE* agriculture—working together the American way, have built within two years a far greater war machine than Hitler's dictatorship and a "super-race" built in ten years.

American production records have been broken. Output has jumped to all-time highs. And quality has increased.

We at Republic are turning out more and better steel than ever before. Because Republic steel makers have the ability and increased capacity—plus the initiative and will to do more that flourish in the hearts of *FREE* men who want to stay *FREE*.

The same freedoms that are winning the war can build the kind of peacetime world that all of us hope for—a happy, comfortable, safe world where men can live, work, speak and worship as they please, secure from want and fear.

And plans are being made for steels that will help build a greater future in post-war days to come. To vast experience already acquired is being added new knowledge gained from the performance of steels in fighting action and in new methods of mass production—plus new developments from Republic's increasing research—to bring you finer steels than ever before.

Is freedom worth fighting for? Millions of the finest of America's youth are betting their lives that it is. Let's do our part to help them by betting our skill, our time, our dollars on freedom, too.

REPUBLIC STEEL CORPORATION
General Offices: Cleveland, Ohio

Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Bldg., New York, N. Y.

Republic

CARBON, ALLOY AND ENDURO STAINLESS STEELS

Sheets—Plates—Pipe—Hot Rolled and Cold Drawn Bars
— Upson Bolts, Nuts and Rivets — Electrunite Tubing

SOUTH BEND LATHES

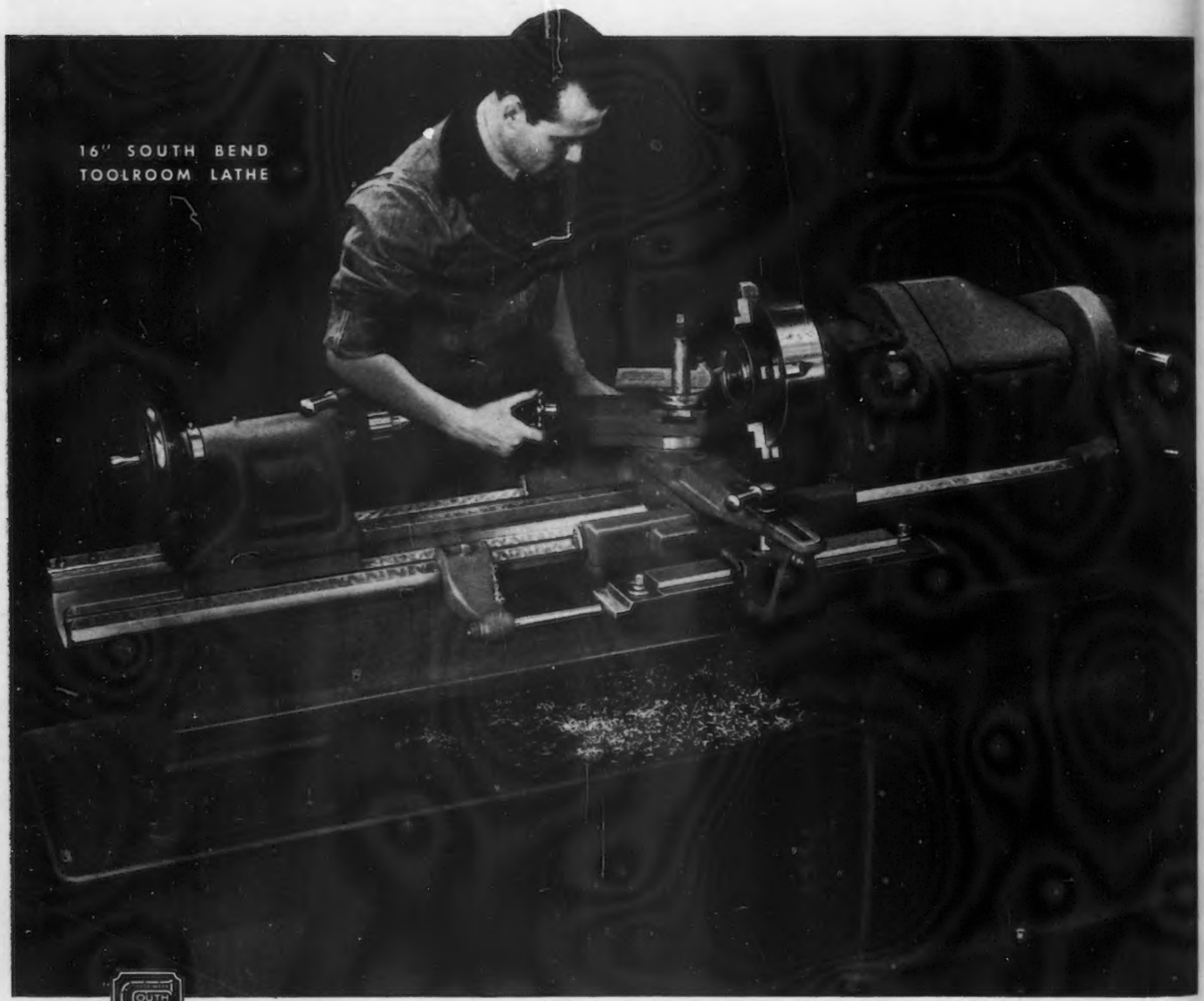
GIVE SKILLED MANPOWER MORE PRODUCING POWER

BUY WAR BONDS

To give our fighting forces the increased striking power of more and better weapons, Industry's skilled manpower must have the increased producing power of fast, accurate tools.

South Bend Lathes squarely meet this requirement. Their rigidity and wide range of spindle speeds permit taking full advantage of the higher cutting speeds that are possible with carbide and diamond tipped tools. Their precision makes it possible to finish turn and bore with such accuracy that subsequent grinding and honing operations can often be eliminated.

South Bend Engine Lathes and Toolroom Lathes are made in five sizes—9″ to 16″ swings. The Turret Lathes are made in two sizes—Series 900 and Series 1000. Write for a catalog.



SOUTH BEND LATHE WORKS

SOUTH BEND, INDIANA • LATHE BUILDERS FOR 36 YEARS

N-A-X High Tensile

welds readily...

into High Strength Weldments for ordnance equipment

It was no mere chance that manufacturers of Army Ordnance materiel selected N-A-X HIGH TENSILE for parts for gun mounts, Jeeps and Tanks and other pieces of equipment. Long before the war N-A-X HIGH TENSILE had won unqualified approval of both fabricator and user, because this high strength steel was easy to form, draw and weld. N-A-X HIGH TENSILE, the really superior low alloy steel, does not air harden. It fuses and mixes with the weld metal readily, easily . . . and can be readily welded by any of the commercial processes.

N-A-X HIGH TENSILE also has great resistance to impact and fatigue in both extremely hot or sub-zero temperatures. It has unusually high ductility, high yield point, high ultimate strength and marked resistance to corrosion and abrasion—properties that make for speedier fabrication and longer life.

Full information is available on N-A-X HIGH TENSILE. Write today for your copy of a new booklet describing the properties and characteristics of N-A-X HIGH TENSILE . . . the truly versatile low alloy steel.

GREAT LAKES STEEL CORPORATION
Detroit, Michigan
Sales Offices in Principal Cities

NATIONAL STEEL

Division of
NATIONAL STEEL CORPORATION
Executive Offices · Pittsburgh, Pa.

More than . . . a printmaking process

WITH an Ozalid machine you make whiteprints direct from your engineering drawings in two fast steps—Exposure and Dry Development . . . the most simple method on record.

The Model B illustrated here is designed for large-scale production; turns out prints at speeds up to twenty feet per minute. →

OZALID CUTS DRAFTING TIME

You can make design changes quicker with Ozalid.

Using an Ozalid transparent print of the original—it's never necessary for the draftsman to redraw any line which remains the same in the new design . . . it's never necessary to employ photographic equipment . . . or to otherwise throttle production.

Ozalid transparent prints are made in the same manner as standard prints—without Van Dyke tieups. Think what this means considering the number of design changes you're making today—the number you'll be making in the postwar period.

Be sure of a "head start" with Ozalid!

OZALID GIVES THESE EXTRA VALUES

Most Versatility

You can do much more with Ozalid. You can make prints of your engineering drawings, charts, and letters which will have blue, black, or maroon lines on a white background. You can make prints on standard, transparent, and foil materials.

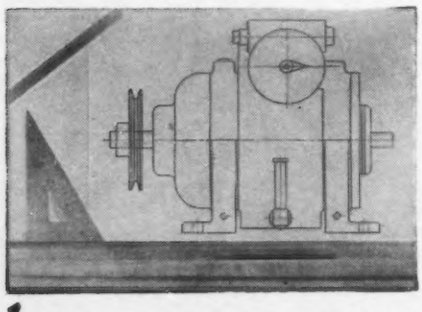
What's more—all Ozalid materials are available in cut sheets, as well as roll stock; thus, by using sheets the size of your originals you can completely eliminate trimming waste.

Low Maintenance Costs

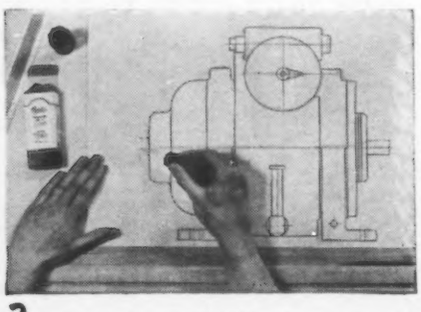
Any inexperienced person can operate an Ozalid Whiteprint Machine. There's never a labor problem, because Ozalid's Dry Development has simplified printmaking—eliminating the liquid baths, the driers, the plumbing connections which demand skilled supervision.

Another result of Ozalid's Simplified Printmaking is low electrical consumption. The Model B, operating at maximum speed, consumes only 4.4 kilowatts.

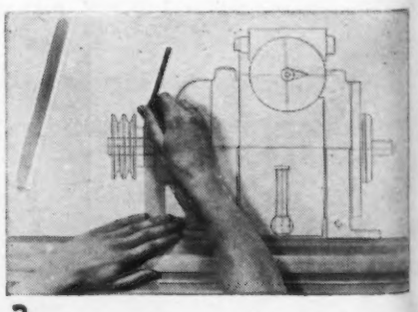
Ozalid Whiteprint Machines are designed for large-scale, medium, and occasional print production . . . and there are dry developing units for those having a suitable printer.



1. **This is** an Ozalid transparent print of an engineering drawing—part of which has to be changed.



2. **The draftsman** quickly eradicates the obsolete lines with a quick-drying corrector fluid.



3. **The new design** is drawn in . . . the desired number of prints can be made from this transparent copy.

OZALID PRODUCTS DIVISION

GENERAL ANILINE AND FILM CORPORATION

Johnson City, N. Y.

OZALID IN CANADA—HUGHES OWENS CO., LTD., MONTREAL

WRITE FOR CATALOG . . . and sample booklet of Ozalid Whiteprints. See how leading manufacturers save time, labor, and materials with Ozalid.

FOR STRONGER, CLEANER RESISTANCE WELDS . . .

Micro-Timing BY ELECTRONIC CONTROL

LIKE THE MAN ON THE FLYING TRAPEZE . . .

. . . synchronization is important to the control of resistance welding current. Especially on short-time welds of a few cycles, random closing of the circuit produces an undesirable variation in weld quality. Synchronous Control starts and stops weld current at the right point of the wave . . . produces high-quality welds of uniform spot size and strength.

Precision timing with electronic control splits seconds into sixtieths and smaller. Resistance welds are sounder, surfaces are less affected and electrodes last longer, give more spots per cleaning.

Westinghouse supplies all the necessary equipment for electronic control of resistance welding. A typical installation, (shown above) uses two Westinghouse units to control a spot welder which handles work up to ¾" in thickness.

1. **SEQUENCE TIMER** controls the sequence of electrode operations—opening and closing them for preset periods accurate to within one cycle or 1/60th of a second.
2. **COMBINATION SYNCHRONOUS TIMER** combines three separate Westinghouse controls in one compact, floor model. **WELD-O-TROL** makes and breaks heavy welding currents as high as 10,000 amperes without flash or noise. **HEAT CONTROL** regulates the heat supplied to the weld from 20 to 100%. **SYNCHRONOUS CONTROL** assures that the power circuit is always closed at the same point on the voltage wave so as to prevent transients which cause uneven welds.

These precision controls save critical materials and increase weld production. Rejects are fewer, welds are faster, more consistent. Ask your Westinghouse representative how electronic control can increase your war production. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-21273

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

RESISTANCE WELDING CONTROL

WE MAKE ALUMINUM, TOO!

We make it out of the scrap that we buy from so many different plants. Your scrap is just as important in the war effort as bauxite—It is important that you see to it that your scrap reaches the nearest aluminum smelter with the least possible delay—

Steel Producers:—Deoxidizing aluminum—notched bar or shot. We are prepared to give you the best possible at the moment you want it at prices that are more than competitive. Send us your inquiries—Get our quotations—

WE WANT TO BUY YOUR SCRAPINGS AND FILINGS!

Whether it be aluminum scrap — brass — bronze — copper — lead — zinc or any other non-ferrous scrap, get in touch with us first — Send your scrap to us and we will send it to war — Consult with us on any problem you have concerning metals — Scrap or Refined.

THE GEORGE SALL METALS CO.
WESTMORELAND AND TULIP STREETS
PHILADELPHIA ★ PENNSYLVANIA

MINE MAINTENANCE

with a Super Service Radial

Today in many large plants the Maintenance Shop is one of the most important and vital departments. Nothing less than the most dependable, most versatile tools can be tolerated in such shops.

ARMY E NAVY
AWARDED SEPT. 10, '42

The above photograph shows one of the three Super Service Radial Drills in the UNDERGROUND MAINTENANCE SHOP of a large mine where they are relied upon for a variety of metal drilling operations.

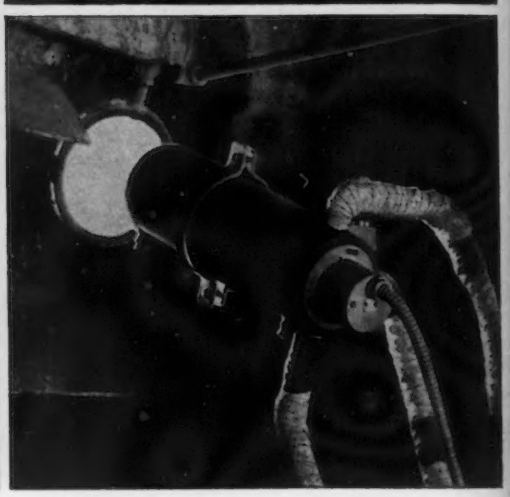
These machines have a wide range of speeds and feeds, long-lived accuracy and features for fast, easy operation. The distinctive features of the Super Service Radial Drills are explained in Bulletin R-24. Write for it today.

SUPER C.B. SERVICE

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

First Helper in an open-hearth shop consulting a Micromax Roof Temperature Controller which cuts fuel down if roof overheats. The fuel-valve drive actuated by the Controller is the rectangular iron box on top of the pipes just behind the man.



Upper picture—Rayotube temperature detector for the Micromax at left, as installed between buckstays at furnace front . . . Lower picture—Rayotube can also look in at back of furnace.

MORE STEEL FROM O-H FURNACES?

Micromax Roof Temperature Control Can Help!

Important increases in the output of an open-hearth furnace usually follow the use of Micromax Roof Temperature Control, because:

1. Heats are finished more quickly. The Helper sets the Controller for whatever roof temperature he considers safe; the Controller and its Rayotube then "watch" the roof continuously and hold a consistently higher temperature than the Helper could maintain, with safety.

2. Furnace needs rebuilding less frequently because roof is not damaged by over-heating.

The Control equipment consists of Micromax Recording Controller, a Rayotube radiation-type temperature detector and a Micromax Electric Control valve drive unit, with its relay. The Micromax may be either the Strip-Chart, shown above, or a Round-Chart instrument.

The Rayotube may be placed at any one of three locations on the furnace. One is between the buckstays at the front of the furnace, and aimed, of course, at the furnace roof; this has the advantage of being convenient to the first Helper, and is especially recommended for tilting furnaces. Another location is at the back of the furnace, looking up at the roof. The third location is in the roof itself, looking down at a special refractory block set in the roof. Furnace type, construction and operating conditions determine location in all cases.

For a general description of Micromax Roof Temperature Controllers, see Bulletin N-33B-600B. If you have a definite application to a specific furnace, send us details and our engineers will make recommendations.

Jrl Ad N-33B-600B(1)

ARMY E NAVY

depends on me!

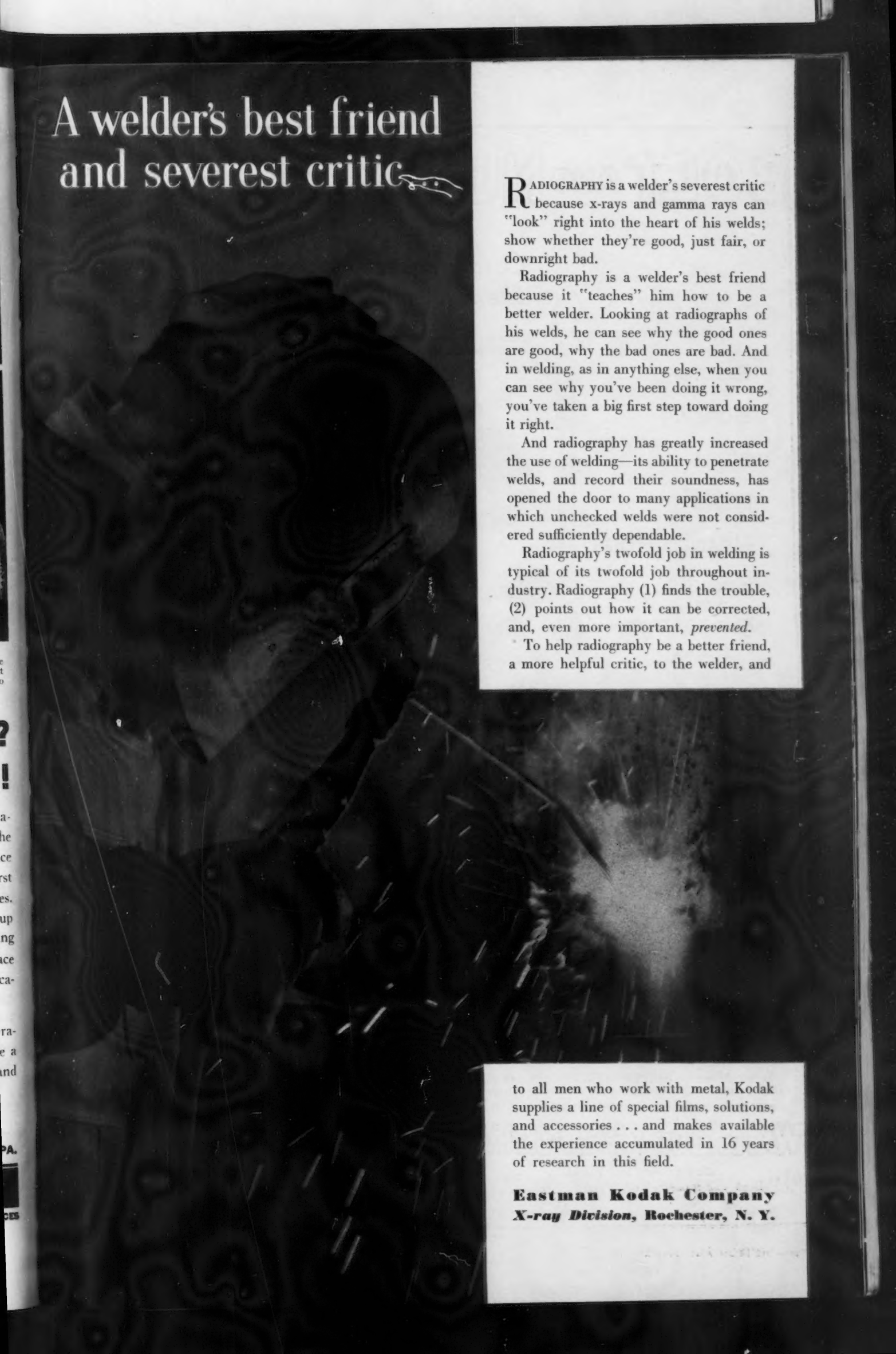
A Slogan for All Americans

LEEDS & NORTHRUP COMPANY, 4956 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

A welder's best friend and severest critic



RADIOGRAPHY is a welder's severest critic because x-rays and gamma rays can "look" right into the heart of his welds; show whether they're good, just fair, or downright bad.

Radiography is a welder's best friend because it "teaches" him how to be a better welder. Looking at radiographs of his welds, he can see why the good ones are good, why the bad ones are bad. And in welding, as in anything else, when you can see why you've been doing it wrong, you've taken a big first step toward doing it right.

And radiography has greatly increased the use of welding—its ability to penetrate welds, and record their soundness, has opened the door to many applications in which unchecked welds were not considered sufficiently dependable.

Radiography's twofold job in welding is typical of its twofold job throughout industry. Radiography (1) finds the trouble, (2) points out how it can be corrected, and, even more important, *prevented*.

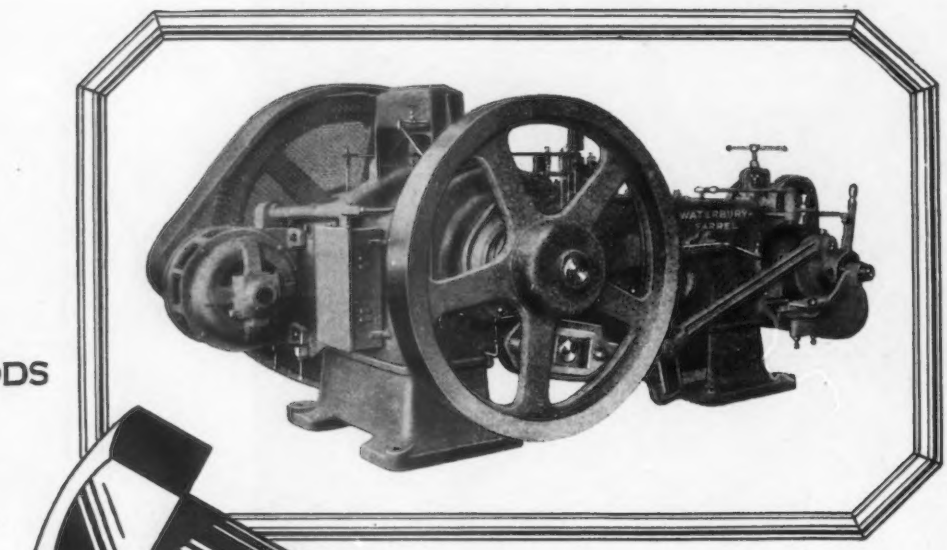
To help radiography be a better friend, a more helpful critic, to the welder, and to all men who work with metal, Kodak supplies a line of special films, solutions, and accessories . . . and makes available the experience accumulated in 16 years of research in this field.

Eastman Kodak Company
***X-ray Division*, Rochester, N. Y.**

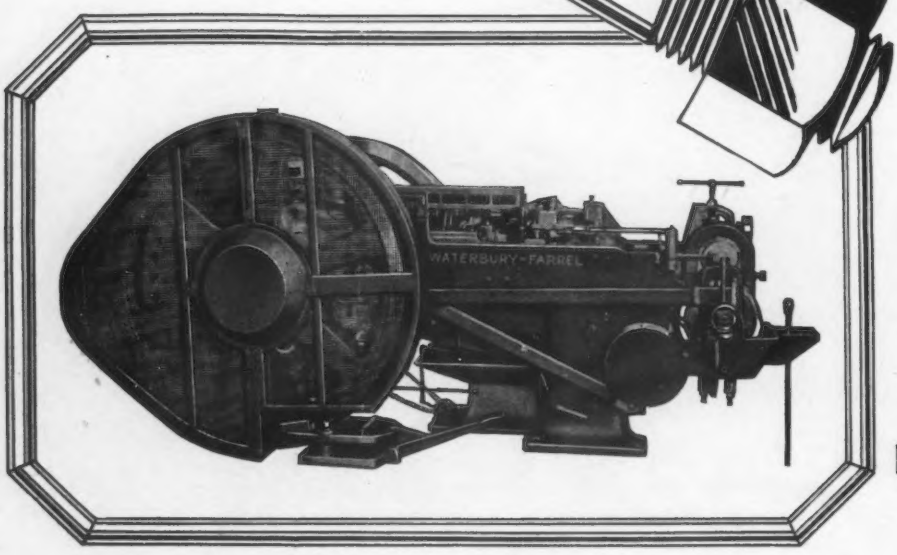
BOLT AND NUT MACHINERY

Cold Process Machinery for the Automatic Production of.....

BOLTS
SCREWS
NUTS
RIVETS
HEADED RODS
SPOKES
BALLS, ETC.



½-inch Open Die Double Stroke Crank Header with geared motor drive. This machine is rated at 70 to 80 headed blanks per minute. Weight 26,875 lbs.



HEADERS
TRIMMERS
POINTERS
THREADERS
SLOTTERS
NUT MACHINES
RIVET DRILLERS
ETC.

½-inch Automatic Nut Forming Machine with geared motor drive. Makes double chamfered nut blanks from cold drawn wire, 80 per minute. Weight 37,300 lbs.

WATERBURY FARREL FOUNDRY AND MACHINE COMPANY

Home Office and Works:
Bank and Meadow Sts., Waterbury, Conn.

Sales Offices:
Cleveland, Chicago, Newark, N. J.

New LEAD-COATED SHEET HAS MANY Virtues

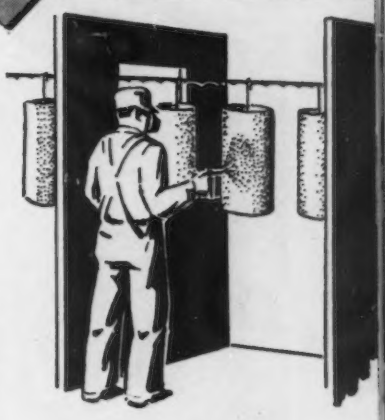
CONTINENTAL STEEL CORP. STEEL Lead-sealed TRADE MARK REG. U.S. PAT. OFF. SHEETS KOKOMO, IND.

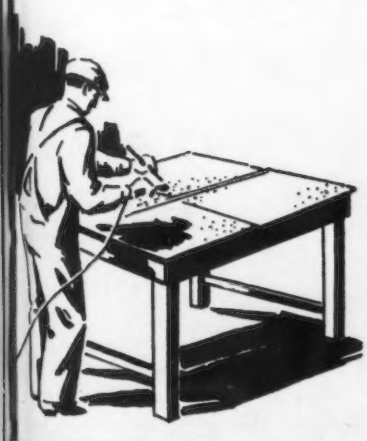
IT HAS *Greater* RUST-RESISTANCE

Lead does not corrode or weather away through galvanic action when in contact with steel. Properly applied, a lead coating for steel sheets affords longer-lived protection against rusting or corrosion of the base metal.

IT *Takes* PAINT

The new lead coating provides an ideal painting surface. LEAD-SEALED sheets TAKE and HOLD paint and synthetic enamels without preparatory treatment. This saves both time and cost in manufacturing operations.





IT SOLDERS *Easily*

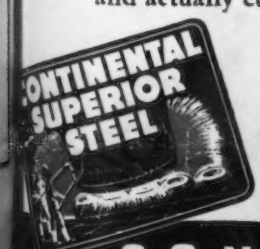
Continental LEAD-SEALED solders fast and easily, and without the use of flux or acid. Less solder is required. Being both simpler and easier than soldering zinc-coated sheets, there is a worthwhile saving in time and effort.

IT'S *More* WORKABLE

Softer, more ductile, LEAD-SEALED sheets possess a high degree of workability. The coating serves as an effective lubricant for dies. It withstands severe forming operations without flaking or peeling.

Already this new sheet has demonstrated superior properties for such uses as: truck and trailer bodies, fire doors, heating and ventilating equipment, chemical containers, gasoline cans, tanks and a score of other products. In many industries, Continental LEAD-SEALED has replaced more critical materials and actually cut costs. LEAD-SEALED offers advantages for many kinds of products. It cannot and is not intended to replace galvanized or long terne sheets for all purposes. The better acquainted users have become with LEAD-SEALED, the better they like it for specific uses for which it is intended. Perhaps this new sheet is your answer to a better product. Write, explain your problems, ask for a sample.

CONTINENTAL STEEL CORPORATION • KOKOMO, INDIANA



SUPERIOR

CONTINENTAL STEEL CORPORATION

PORTABLE SNAGGING WHEELS . . . . . .

For the *correct wheel* on *every* high speed snagging job, consult BAY STATE!

A bulletin containing specific snagging recommendations is yours for the asking.

BAY STATE
WHEELS of PROGRESS

BAY STATE

ABRASIVE PRODUCTS CO., WESTBORO, MASS. U.S.A.

DE WALT

CUTTING MACHINES

help put them in action!

Speedy, tough, maneuverable—the jeep has taken its place as a highly important cog in America's war machine. Helping to deliver jeeps and other war vehicles faster—are DeWalt Cutting Machines. These machines, introducing many new methods of cutting, enable manufacturers to save man power, increase volume and handle fast cutting jobs with an accuracy heretofore unknown.

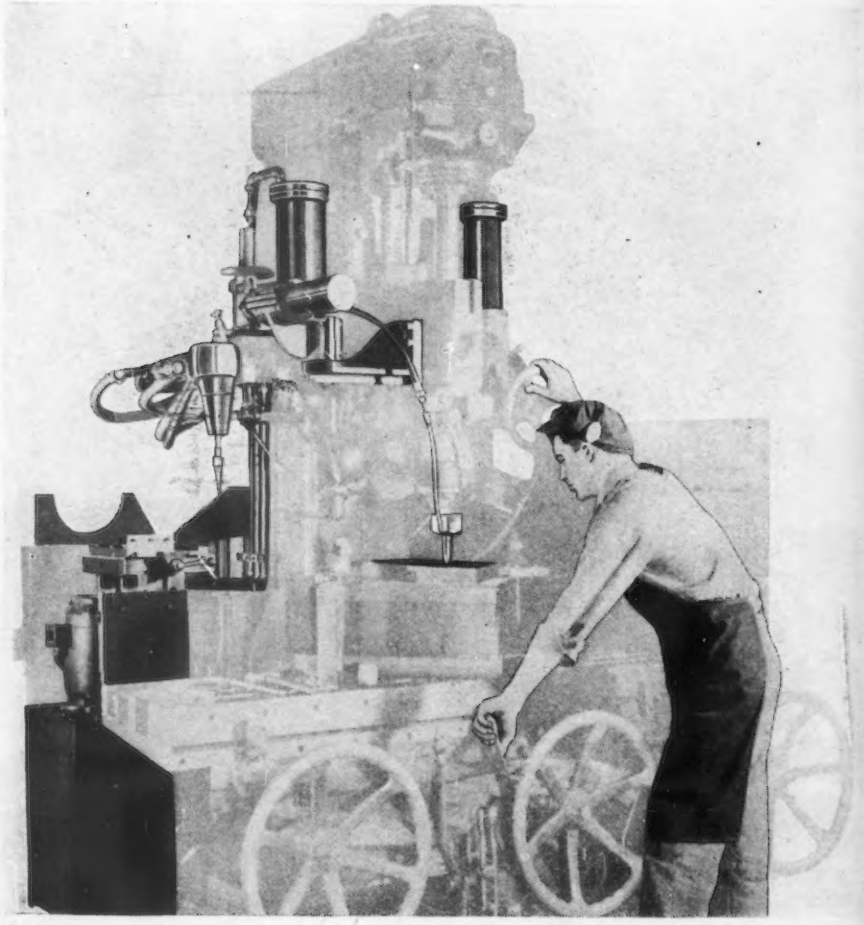
DeWALT PRODUCTS CORPORATION

Lancaster, Pennsylvania

THIS DIE SINKER

Turned to Turchan

FOR *FASTER, MORE EFFICIENT* PRODUCTION!



DIE SINKING, one of the more difficult machining operations in any plant, is a comparatively simple task when the plant is equipped with a Turchan Follower.

Shown herewith is a Turchan Follower attached to a Reed-Prentice No. 5 mill. This Turchan equipped machine, located in one of the largest drop forge plants in the United States, is in almost constant use machining airplane engine crankcase dies.

One of the paramount virtues of Turchan equipment is simplicity of operation. This all hydraulic duplicator, attached quickly to any standard type lathe, planer, grinder, shaper or mill, is handled easily by any operator. The high degree of skill normally required for die sinking and other such operations is not necessary when Turchan Followers are employed.

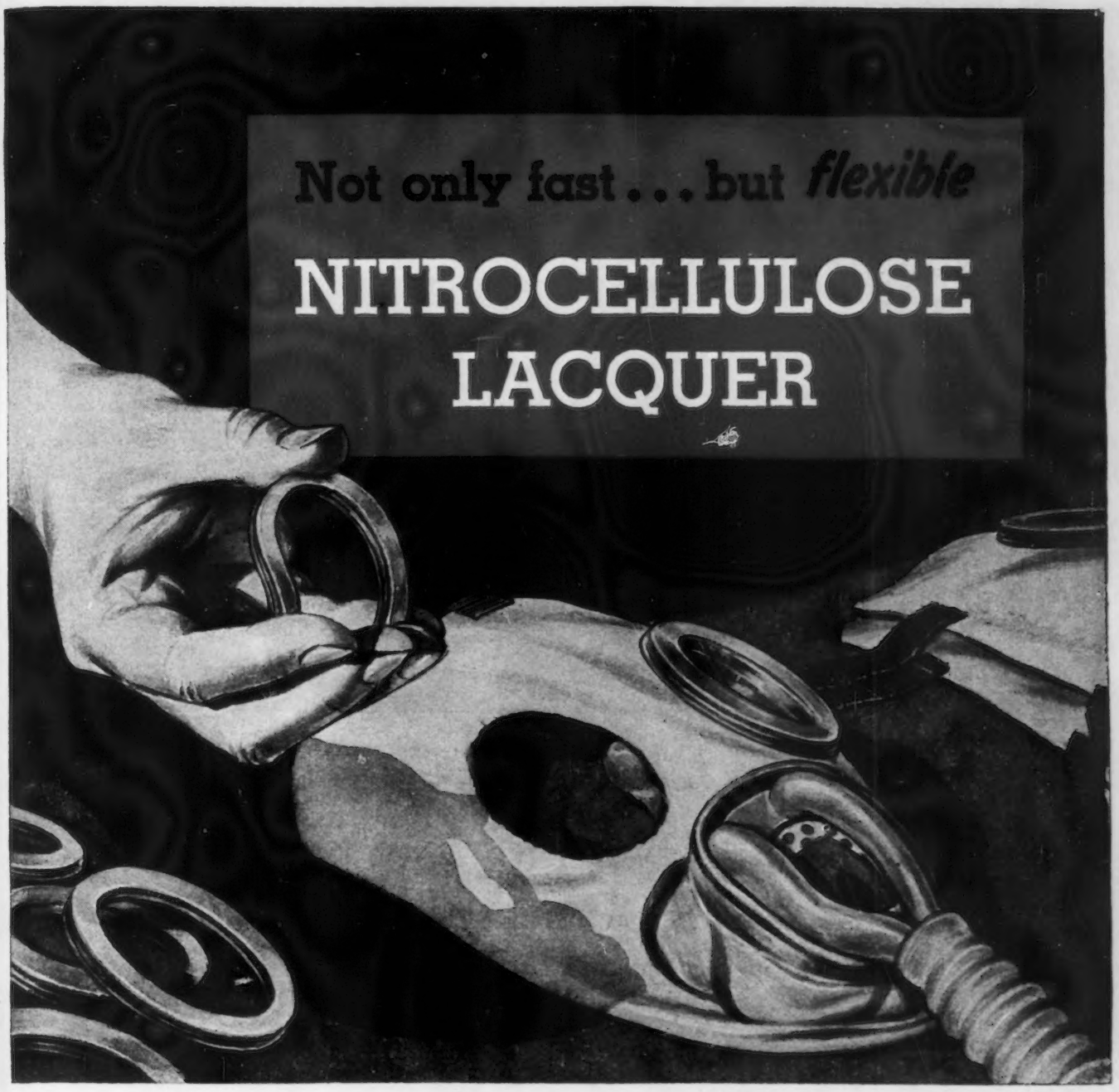
Turchan Followers, on the other hand, do not interfere with normal use of the machine. The one pictured here can be disengaged by removing two nuts. The operators of this equipment are saving time, money and reject worries by *Turning to Turchan* You, too, can *Turn to Turchan* and do likewise. Send for our new booklet today and let our engineers explain Turchan all hydraulic duplicating to you.

"Turn to Turchan"

TURCHAN FOLLOWER MACHINE CO.

Originators of Hydraulic Duplicating Attachments

8257 Livernois Avenue Detroit, Michigan



Fabrication methods—as in the case of the gas mask eyepiece rim illustrated above—frequently call for the forming of metal parts after they have been lacquered . . . nitrocellulose lacquers have the flexibility necessary for this job.

In fact, these lacquers—long known as the fastest drying finish available—are also tough, durable, and resistant to water and chemicals. That is why they are specified where the going is rough . . . for wooden and metal surfaces on numerous types of military equipment and essential civilian products.

For speedy, effective finishing of vital military and civilian goods, join the trend to lacquers based on nitrocellulose. Hercules does not make the finished lacquer but supplies nitrocellulose for essential lacquer requirements.

CELLULOSE PRODUCTS DEPARTMENT

HERCULES POWDER COMPANY

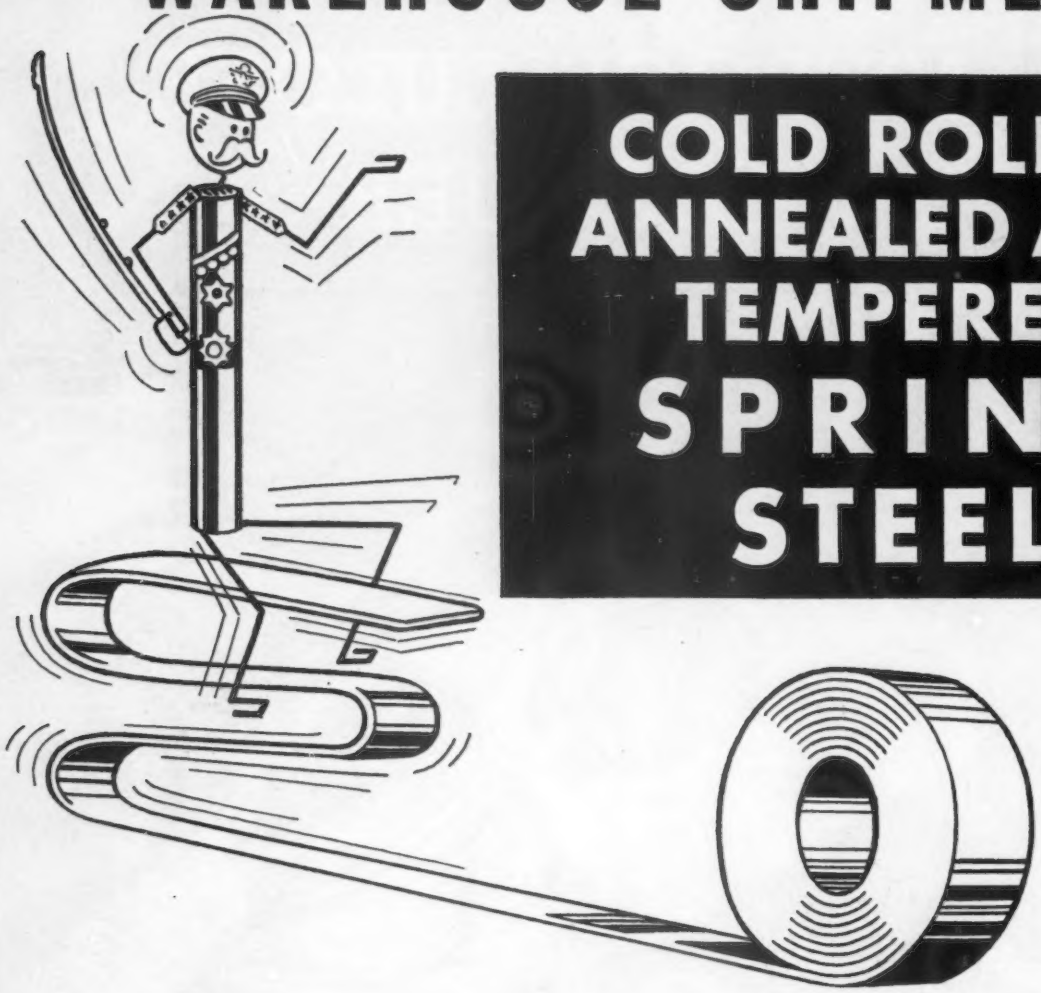
INCORPORATED

979 MARKET STREET • • WILMINGTON, DELAWARE

AAA-80

NITROCELLULOSE FOR LACQUER

Immediate WAREHOUSE SHIPMENTS



COLD ROLLED ANNEALED AND TEMPERED SPRING STEEL

TEMPERED

GAUGES—.002 to .062
BLUE—BRITE
BLACK—STRAW
FEELER GAUGE

GENSCO

ANNEALED

GAUGES—.002 to .187
L.R. GRADE—.60- .70 CARBON
M.R. GRADE—.70- .80 CARBON
H.R. GRADE—.90-1.05 CARBON

GENERAL STEEL WAREHOUSE Inc.

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NEW YORK	CINCINNATI	MILWAUKEE	ST. LOUIS
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Immediate WAREHOUSE SHIPMENTS

THIS IS HOW TO *Prevent* CARBURIZATION or DECARBURIZATION

Fig. 1+2. Shows sample of carburized SAE 1015 Steel, treated on top and right hand edges to prevent carburization, as compared with untreated edges.

To prevent carburization or decarburization use Park's No-Carb liquid paint. It is a ready-to-use premixed product that requires no further additions or dilutions for application.

No-Carb is an excellent paint for use on finished molybdenum high-speed tools, or alloy steels, before and after fabrication, for prevention of decarburization (see photograph at right).

When applied to clean surfaces of low-carbon steels, No-Carb prevents carburization in selected areas (see photograph at left).

There is also a time saving advantage in using No-Carb, because on most jobs it can be applied by brushing, dipping or spraying directly from the can after stirring—it is not necessary to add to or dilute it.

For further information, prices, and delivery promises wire or write today.

Fig. 2+2. Shows sample of molybdenum high-speed steel, hardened after treatment of top and right hand edges with No-Carb, while other two edges are unprotected.

★ ★ ★

Thirty-two years ago the Park Chemical Company began the manufacture of heat treating compounds. Today, Park's *Laboratory Controlled Products* are recognized for high quality by manufacturers who demand the best results in their heat treating departments. With the recent installation of one of the most modern heat treating and chemical laboratories in the country, Park has taken another step forward in giving its customers the advantage of better metallurgical analysis of their heat treat problems. This adherence to *Laboratory Controlled Products* has built for the Park Chemical Company an enviable reputation for selling products that are pre-tested for each particular job. This effects a saving to Park customers by eliminating trial and error methods on production lines.

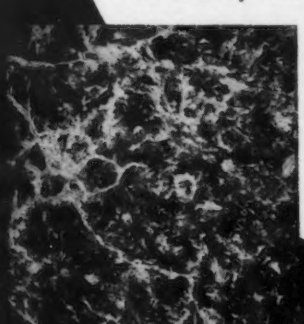


Fig. 3 - 50. Shows steel sample edge *unprotected* by No-Carb, where normal carburization has taken place.

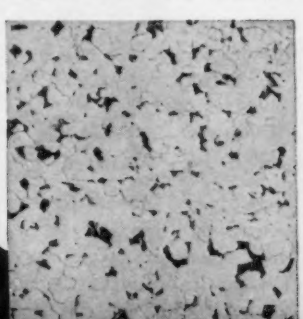


Fig. 4 - 50. Shows opposite edge of same sample, *protected* by No-Carb, where no carburization is evident.

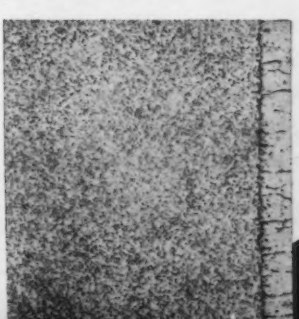


Fig. 5 - 50. Shows edge of hardened steel, *unprotected*, with decarburization evident on same.

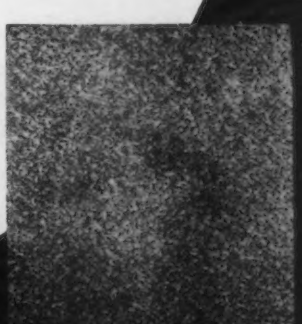


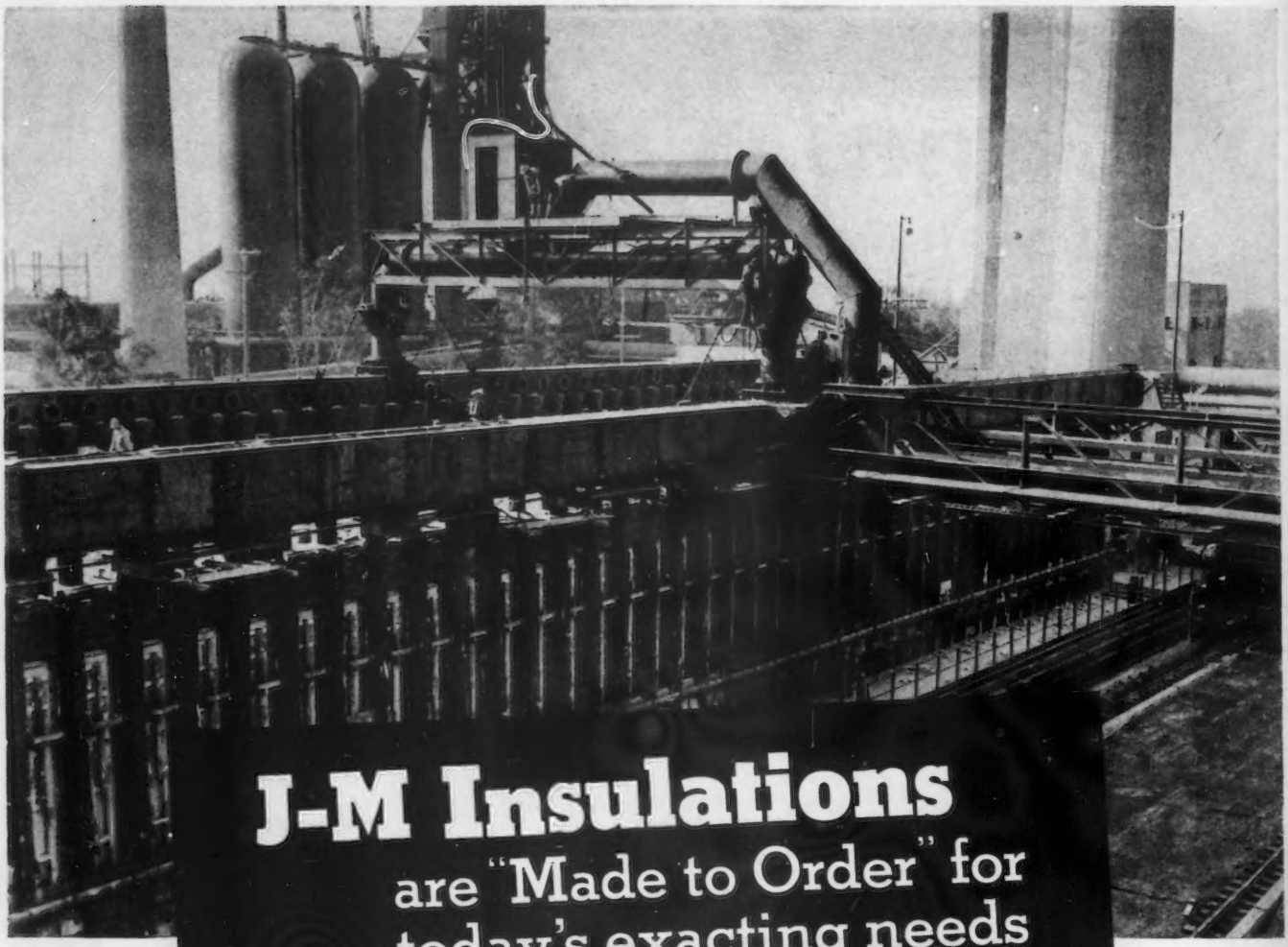
Fig. 6 - 50. Shows opposite edge of steel *protected* with No-Carb, where no decarburization is found, indicating excellent surface protection.

Park

PARK CHEMICAL CO.
DETROIT . . . MICHIGAN

● Liquid and Solid Carburizers ☆ Cyanide, Neutral and High Speed Steel Salts ☆ Lead Pot Carbon ☆ Charcoal ☆ Coke ☆ No Carb. ☆ Carbon Preventer ☆ Quenching and Tempering Oils ☆ Drawing Salts ☆ Metal Cleaners ☆ Liquid Grain Cement

8000 MILITARY AVE. DETROIT, MICH.



J-M Insulations
are "Made to Order" for today's exacting needs

J-M Industrial Insulations cover every type of heat control. Each type of insulation is tailor-made to fit the particular job for which it was designed. In addition: Johns-Manville's 85 years' experience in every conceivable type of insulation problem makes it possible for J-M Engineers to design insulation applications for special conditions with utmost speed, thoroughness and economy. Following are just a few of the many types of J-M Industrial Insulations:

INSULATION FOR TEMPERATURES TO 1900° F. J-M Superex Blocks have long been standard for this service. High heat resistance, low thermal conductivity. Sizes 3″ x 18″, 6″ x 36″ and 12″ x 36″; from 1″ to 4″ thick.

FURNACE INSULATION UP TO 2600° F. J-M Insulating Brick and Insulating Fire Brick are available in 7 types, with temperature limits ranging from 1600° F. to 2600° F. All provide light weight, low conductivity.

FOR TEMPERATURES TO 600° F. J-M 85% Magnesia has been for many years the most widely used block and pipe insulation for temperatures to 600° F. and, in combination with Superex, for higher temperatures. Maintains high insulating efficiency. Standard block sizes 3″ x 18″, 6″ x 36″ and 12″ x 36″; from 1″ to 4″ thick.

FOR STEAM LINES UP TO 700° F. J-M Asbesto-Sponge Felted Pipe Insulation is recommended where maximum efficiency, high salvage and resistance to abuse are essential. For temperatures over 700°, used in combination with Superex. It is available in 3-ft. lengths, from 1″ to 3″ thick, for standard pipe sizes.

SIL-O-CEL C-3 CONCRETE—Cast on the job from Sil-O-Cel C-3 aggregate and cement. Sets up into a strong, durable semi-refractory insulating concrete for temperatures up to 1800° F. Crushing strength: 1000 lbs. per sq. in.

For details on these materials, and on the complete J-M Insulation line, write for Catalog GI-6A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville
INDUSTRIAL INSULATIONS

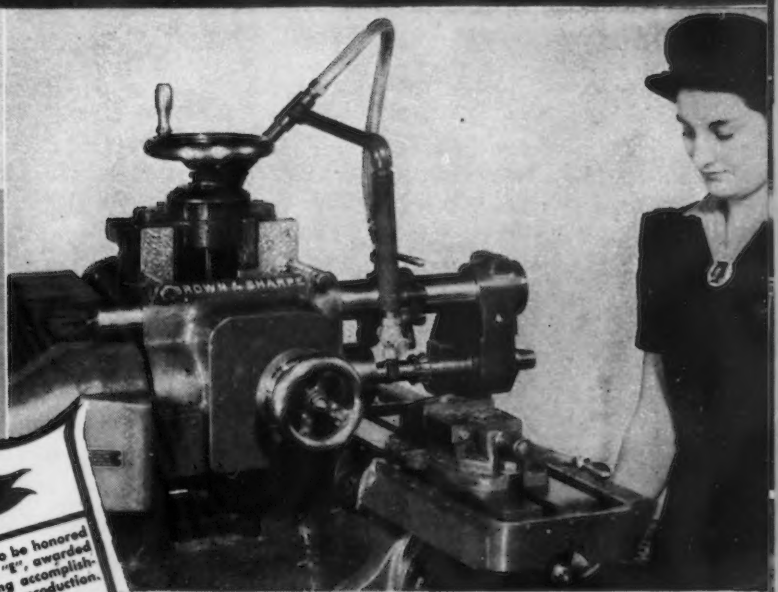
FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

ALL № 000's FEATURES FIT INTO TODAY'S LIGHT MILLING REQUIREMENTS

EASY AND QUICK SET-UP

Easy Adjustment and Positioning — Transverse, vertical and table reversal
Easy Feed Changes — Pick-off gears
Easy Speed Changes — Pulleys and V-belt
Only One table dog to set

SIMPLE AND RAPID OPERATION



Automatic Cycle — Simply load . . . press starting button . . . await return of table to loading position
Rigidity for reasonable cutting rates
Suitable speeds and feeds for ferrous and non-ferrous materials

DELIVERIES ARE GOOD
on New No. 000 Plain Milling Machines

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

BROWN & SHARPE

This simple test shows how the Concave Side

Cuts Belt *and* Power Costs!

Have someone bend a V-belt exactly as it bends in going around its pulley. As it bends, grip its sides with your fingers. You will *feel* those sides *change shape.* If the sides were straight before bending, they become *convex* as the belt bends. (See Figure 1 on the right.) Note how the sides *bulge out.*

Now try the same test with a belt which has the patented Concave side. You will feel the *same shape change*—but what a *different result!* The sides do not become *convex.* They become perfectly straight. The bent belt has a shape that exactly fits its sheave groove—as shown in Figure 2.

Two savings result. FIRST:—There is no side-bulge and this means uniform sidewall wear—*longer life!* SECOND:—There is a full side-width grip on the pulley and this carries heavier loads without slippage—saving the belts and also saving your *power!*

Only belts built by Gates are built with the Concave side, which is a Gates patent.

What Happens When a V-Belt Bends


FIG. 1


FIG. 2

434

THE GATES RUBBER COMPANY

Engineering Offices and Stocks in All Large Industrial Centers

GATES VULCO ROPE DRIVES

CHICAGO, ILL. 549 West Washington
NEW YORK CITY 215-219 Fourth Avenue
ATLANTA, GA. 738 C. & S. National Bank Building
LOS ANGELES, CAL. 2240 East Washington Boulevard
DENVER, COLO. 999 South Broadway
DALLAS, TEXAS 2213 Griffin Street
PORTLAND, ORE. 333 N. W. 5th Avenue
SAN FRANCISCO, CAL. 1090 Bryant Street

ILE QUALITY CONSERVES FILE STEEL

THEY WEIGH THE SAME

. . . but it's the work they do that counts

"Don't waste important materials" is the nation's war-effort warning. The most effective way to conserve tool steel is to make it do more work—through top-quality tools.

A Nicholson or Black Diamond file contains no more steel than an inferior file of the same size and shape. But, compare the number of efficient file strokes the user can get from each, and the quality product will outlast and outperform the other every time—usually by a wide margin.

Thus file quality is also a big *labor-cost* factor. The difference in cost between good and inferior files isn't a "drop in the bucket" compared to the difference in labor values they represent.

So correct in design, so accurate in cut, so uniform in hardness, and so carefully inspected and "block" tested are Nicholson and Black Diamond files that Nicholson is able to *guarantee TWELVE PERFECT FILES IN EVERY DOZEN.*

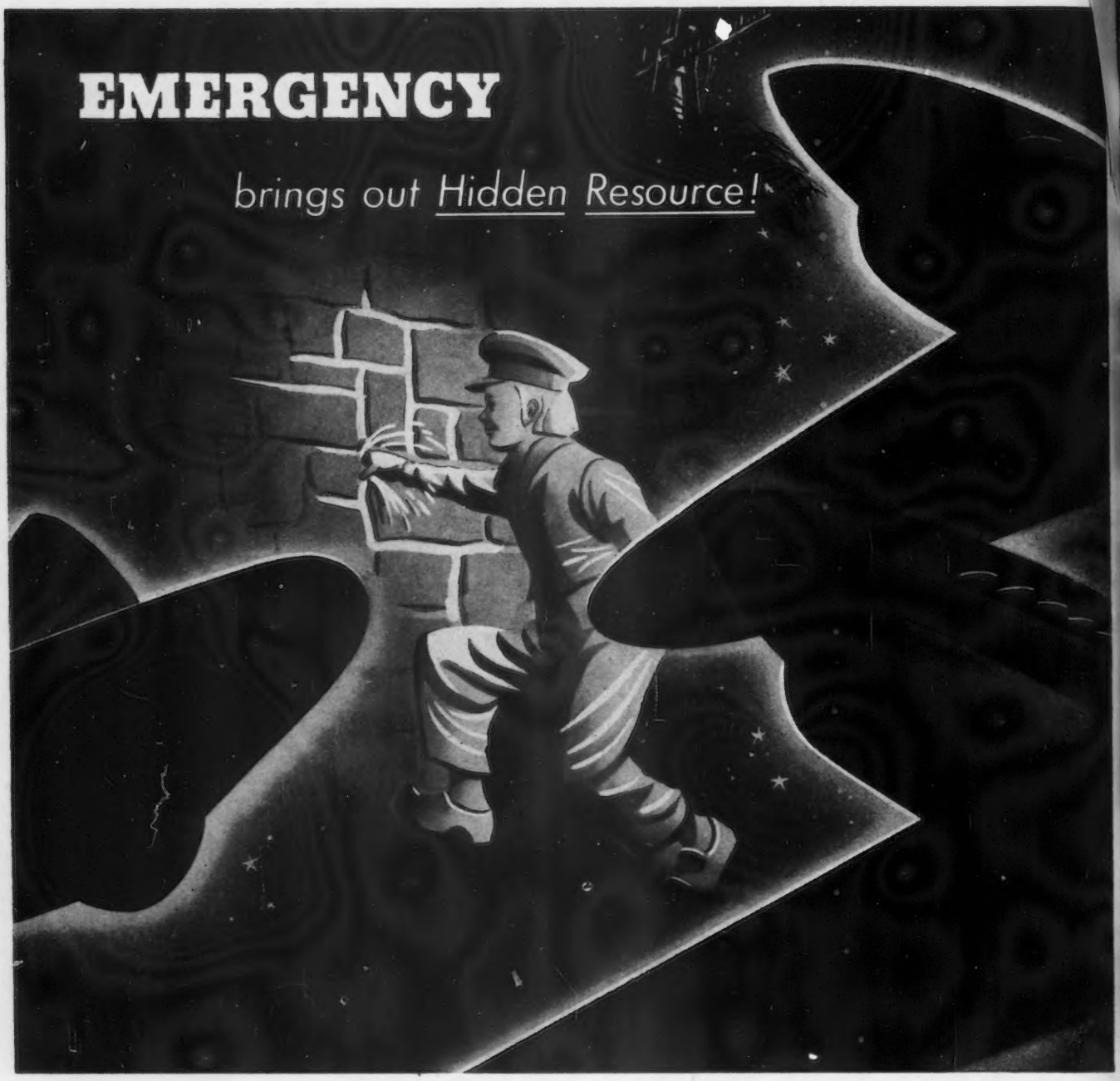
FREE BOOK, "FILE FILOSOPHY"—48 interesting, profusely illustrated pages on files and filing . . . with high-lights on proper use and care and how to select *The right file for the job.* For production and purchasing heads, foremen, key mechanics.

NICHOLSON FILE COMPANY, 31 ACORN ST., PROVIDENCE, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES *FOR EVERY PURPOSE*

NICHOLSON U.S.A.



FERRO-BORON as an alloying material has gone into war production faster and to better purpose than could have been foreseen. The urgency of need has brought this about.

Boron is now an ingredient in vast quantities of high-grade irons and steels for armament, and for various demands of industry. Among the properties to which Boron contributes are hardenability and strength; and by contributing to these it eases the demand for some of the scarcer elements like molybdenum, chromium, and nickel.

A simple, economical, and highly satisfactory form in which to employ Boron for such use is a special Ferro-Boron developed by the Molybdenum Corporation. Compositions and procedures have been minutely checked and clearly defined.

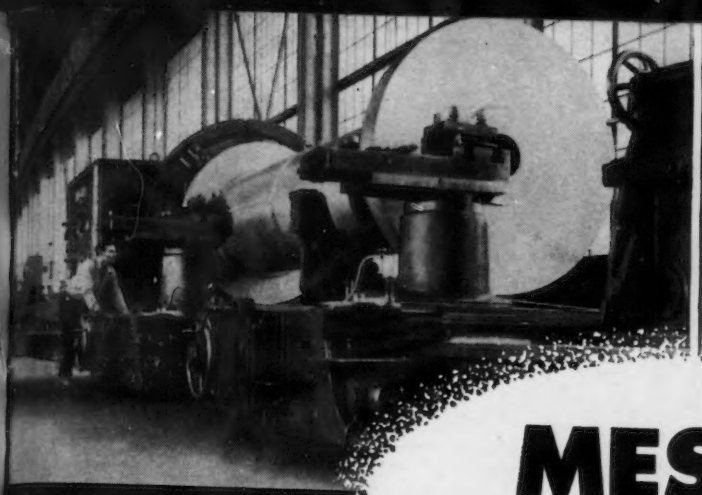
Literature is available. On any application of Boron, Molybdenum, or Tungsten, correspondence is invited.

AMERICAN Production, American Distribution, American Control—Completely Integrated.
Offices: Pittsburgh, New York, Chicago, Detroit, Los Angeles, San Francisco, Seattle.
Sales Representatives: Edgar L. Fink, Detroit; H. C. Donaldson & Co., Los Angeles, San Francisco, Seattle.

MOLYBDENUM **CORPORATION OF AMERICA**
GRANT BUILDING **PITTSBURGH, PA.**

MCA

MESTA FORGINGS

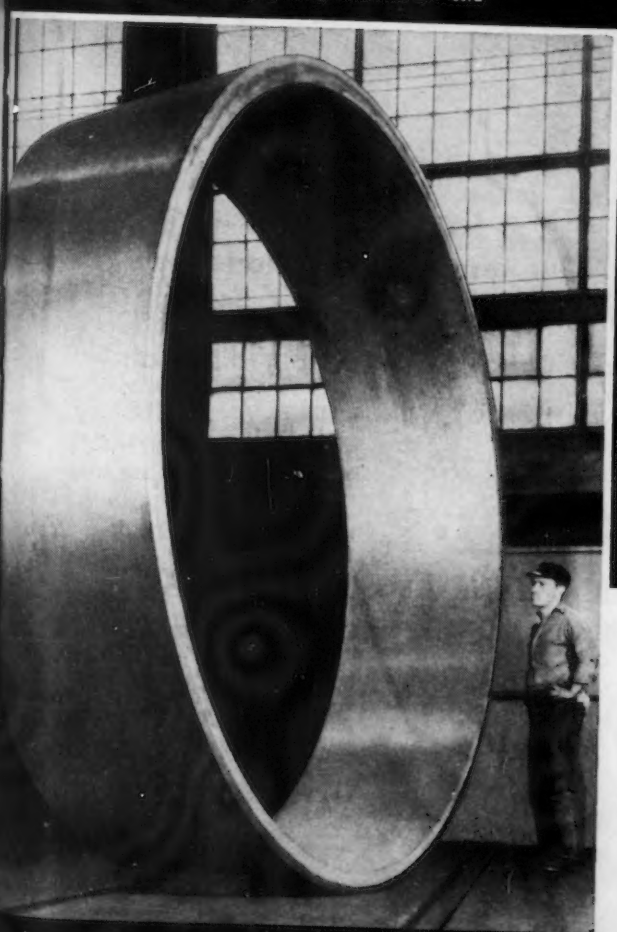


Massive Forged Rotor Shafts for ...t Turbines at the World's Largest Dams

One Piece Forged Steel High Pressure Accumulator Bottle

An Intricate Forging Being Machined at Mesta

Propeller, Stern Tube and Line Shafts for Ships are Produced Complete in the Mesta Plant



...d Foot Reduction Gear Ring Used in Ship Propulsion, Forged in One Piece by Mesta

Group of Mesta Forged Hardened Alloy Steel Working Rolls for Cold Mills

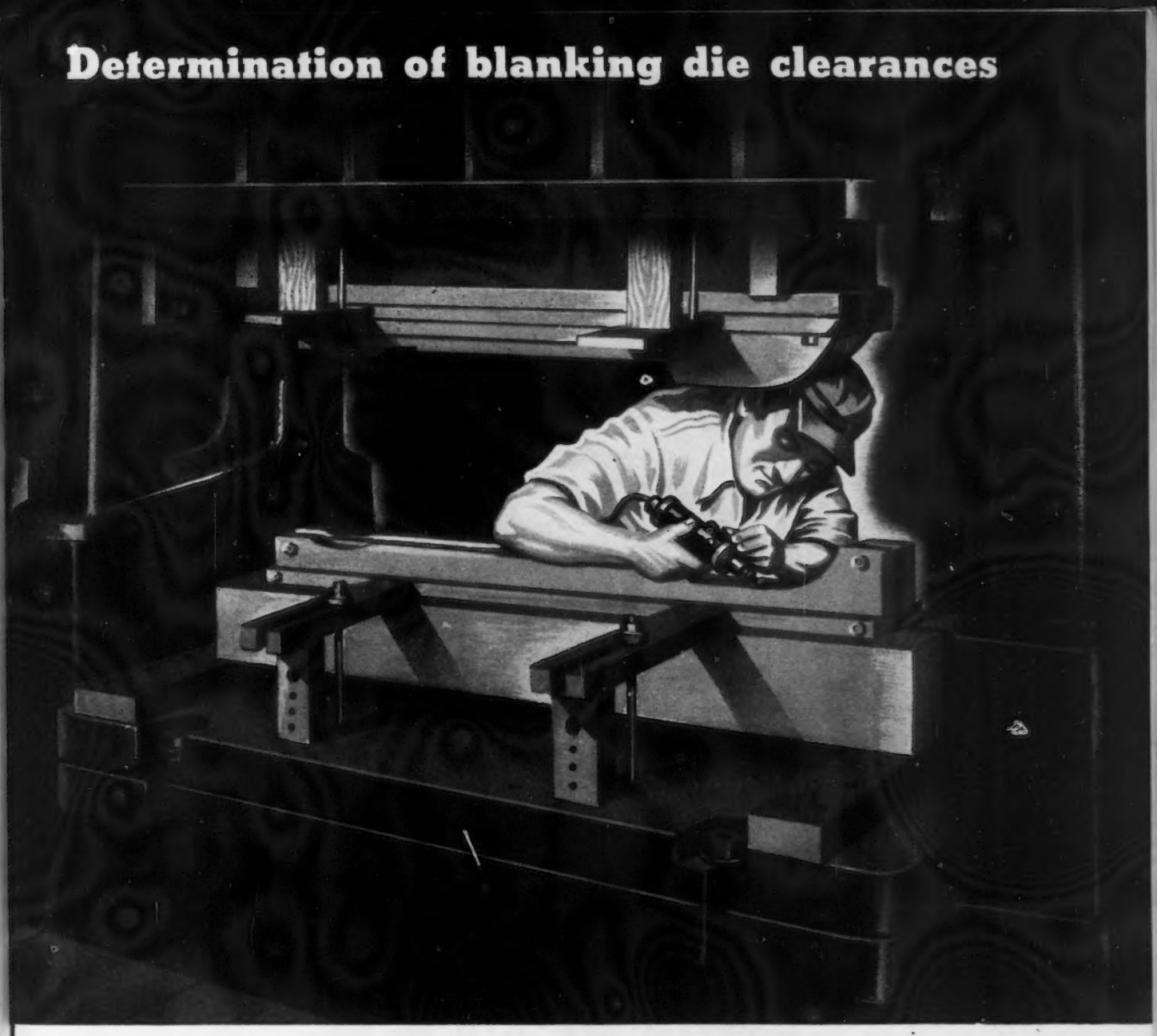
The Army-Navy "E" Flag with three stars, flies over the Mesta plant.

Group of Forged Steel Columns for 14,000 Ton Pure Hydraulic Forging Press

BUY MORE · WAR BONDS

MESTA MACHINE COMPANY . . PITTSBURGH, PA.

Determination of blanking die clearances



Information supplied by an Industrial Publication

Determination of proper blanking die clearance depends on several factors; thickness and physical properties of stock, relation of punch diameter to stock thickness, specified part tolerances and press power and size.

Recommendations of material suppliers regarding clearances for every type of blanking operation can usually be followed. Lacking recommendations, or when clearance must be determined by experiment certain simple rules give reasonably accurate results.

The amount of clearance varies from 5 to 12% in direct proportion to the stock thickness. Closer tolerances call for smaller clearances. The following table gives general average total clearances.

	Close Tolerance	General Run
Brass and Soft Steel	5%	8%
Medium Rolled Steel	6%	10%
Hard Rolled Steel	5-7%	12%

When the blanking or piercing hole must be held to a close tolerance, clearance is added to the punch dimensions. When the blanked part must be held to close tolerance, clearance is subtracted from the dimensions.

EVEN A MINOR CASE OF LOST-TIME EYES costs far more than any pair of AO Safety Goggles

When one of your workmen suffers a minor eye injury, here's a typical picture of what happens: He stops work and goes to the First-Aid station for treatment. Usually he is sent home to nurse his injury. Next day he returns to work and has two brief treatments at the First-Aid room.

Now, let's estimate costs. First, the workman suffers pain and annoyance. He loses 3 or 4 hours' pay. Your company's expenses include items such as these:

Machine idle for 3 or 4 hours . . . First Aid . . . Treatment Medical Supplies . . . Foreman's time on case . . .

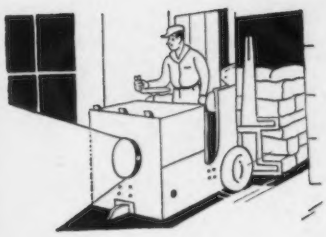
Now, compare these costs with the price of a pair of comfortable AO safety goggles. You'll find that even a *minor* eye accident is now costing you two, three, five, maybe *ten* times as much as a pair of AO Safety Goggles designed to prevent eye accidents from happening.

Make sure that your workers have AO eye protection. For information, advice and full cooperation, get in touch with the nearest AO branch—there's one in every principal industrial center throughout the United States and Canada —or have an AO representative call at your office.

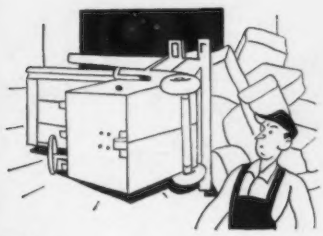
American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS



Emergency Lights. A Midwestern manufacturer has a bright idea for emergency lighting. He equipped a number of his battery industrial trucks with headlights and conventional electric outlets. Then he installed 32-volt lighting circuits at various key points in the plant. During power failures each truck proceeds to a designated point, the line is plugged in and the emergency lights go on.



Turnover. One of the reasons experienced industrial truck operators prefer alkaline batteries is that they know the steel construction of these batteries withstands rough usage. They have had their share of accidents in which the trucks overturned without damage to the batteries. And they know by experience that the common electrical accidents don't damage them either.

Quick Battery Exchange. An important reason for the ability of battery industrial trucks to provide dependable 168-hour duty lies in the fact that the batteries work in relays, as railroad locomotives do. Like the train, the truck maintains a schedule. Like the locomotives, one battery furnishes motive power while another is charged and serviced. And with modern power hoists, exchange of batteries is a matter of only a minute or two.

Edison Storage Battery Division
Thomas A. Edison, Inc.
WEST ORANGE, N. J.

POWER for Production

In production, it's what gets done that matters! And for *maximum* production there is nothing more important than *uninterrupted* handling of materials. Of course, man power is essential; so are plant and equipment. But none of these can work at full capacity unless there is a smooth, bottleneck-free flow of materials all the way through receiving, stores, process, assembly and shipment.

It's self-evident, therefore, that the battery industrial trucks in our war industries need the most dependable, trouble-free storage batteries that American inventive genius has produced. It's reassuring that so many of them—a majority in fact—are powered by the *alkaline* type of battery, an invention of Thomas A. Edison. No more durable, reliable portable power source is known.

INDUSTRY NEEDS THE DEPENDABILITY OF

Edison Alkaline BATTERIES

CONSOLIDATED LIBERATOR

Tough Guy

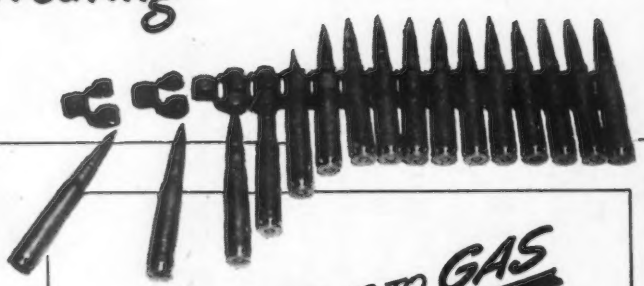
Big, rough, tough Liberators roam the sky fronts of the world on 'round the clock missions for victory, and peace. You've read about their successes in yesterday's newspapers . . . and tomorrow's stories will be even more startling. We're not fooling anybody, nor trying to...these battle-buggies of the air are good, *plenty good.* Besides their roles in the fighting theatres, Liberators have flown leading statesmen and military leaders to many of their war-planning conferences. Here's real dependability...demonstrated by the Liberator's day-in and day-out performance.

Triplett & Barton laboratories X-Ray vital stress parts in the Liberator. This service, along with others performed by Triplett & Barton, has underwritten safe assurance against structural failures...and against excessive waste of machine-time during manufacture. Vital war industries are invited to refer their particular metal problems of all types to Triplett & Barton technicians. These services may help you: X-Ray and Gamma Ray analysis–Physical and Electrical testing–X-Ray Diffraction–Chemical and Spectrographic diagnosis–Metallography–Heat Treatment and Foundry Sand Testing–Hi-Speed and Microphotography, and others.


MORE PRODUCTION PER MAN HOUR
These smaller size Niagara Inclinable Presses offer the same design features of larger Niagara Models. The instant acting 14-point sleeve clutch is an important factor in increasing the output per man hour. It is possible that one or more of these presses can help you in speeding up production of urgently needed wartime material.
A1¼
A1½
A1¾
A2
A2¼
A2½
NIAGARA
NIAGARA MACHINE & TOOL WORKS
BUFFALO 11, N. Y.
District Offices: DETROIT CLEVELAND NEW YORK
BUY UNITED STATES WAR BONDS AND STAMPS

Direct gas-heated continuous conveyor type hardening furnace for production of steel belt links.

To "keep 'em rolling" in the air calls for GAS heat-treating



THE TREND IS TO GAS

FOR ALL INDUSTRIAL HEATING

When an American fighter plane is maneuvered into the perfect spot to "let 'em have it," there can be no risk of a jammed machine gun or a parted cartridge belt. With so much depending on absolute workability of parts, small wonder the Army is so particular about specifications and proving tests on machine-gun metallic belt links.

Ammunition is fed to a modern machine-gun by means of a continuous belt in which the shells act as pins to join the metallic belt links together as in the mill illustration above. At a firing rate of more than ten a second, the metallic link must fit not only the shell but the gun-firing mechanism as precisely as the shell itself. *Such precision calls for Gas heat-treating.*

This is only one of hundreds of Gas heat-treating operations carried on in America's industrial plants today . . . not only for parts for guns, planes and bombs, but for tanks, ships and many other munitions of war.

Call your Gas company if your plant has a heat-treating problem—or any problem involving the heating of metals for war production.

AMERICAN GAS ASSOCIATION
INDUSTRIAL AND COMMERCIAL GAS SECTION
420 LEXINGTON AVENUE, NEW YORK

are leading the Spearhead of Attack

American tanks, airplanes and mobile guns are showing tremendous striking power on every battle front. They are tough to stop because their vital parts are made of special "War Steels" of exceptional ruggedness, wear resistance and ability to withstand heavy stresses and shock.

B & L Cold Finished Carbon and Alloy Bar Steels are helping to safeguard the drive and mobility of American tanks, where they are used for important engine and transmission parts. In airplane manufacture, B & L furnace treated Alloy Steels are employed to provide a combination of strength and lightness in motor parts and structural members. In fabricating shells and gun parts, B & L Free-Cutting Steels are saving time in machine work and reducing tool wear, besides insuring dependable service.

B & L engineers will gladly help you with your steel problems, both in simplifying your production and in obtaining required performance characteristics.

COLD FINISHED STEEL AND SHAFTING

Write for the new B&L Spindle Speed Chart to figure machining rates on Cold Finished Bar Steels. Sent on request.

BLISS & LAUGHLIN, INC.

HARVEY, ILL. Sales Offices in All Principal Cities BUFFALO, N. Y.

KUT KOST

The New Centrifugally Cast Cutting Alloy Containing BORON

For: HIGHER SPEEDS
HIGHER FEEDS
INCREASED OUTPUT
DECREASED COST

RECOMMENDED SPEED INCREASES OVER HIGH SPEED STEEL:

Low tensile strength materials	100% to 300%
Cast iron and semi-steel	100% to 300%
Steel castings	50% to 200%
Tough alloy steels	100% to 400%
Stainless and manganese steels	100% to 500%

GRADES

KUTKOST is supplied in three grades varying only in hardness.

GRADE V **Hardness—Rockwell "C" 61-63**
Toughest grade. Use where toughness is most important such as on heavy or jump cuts (1/32" feed and up) on high tensile strength materials.

GRADE X **Hardness—Rockwell "C" 65-67**
Medium Tough grade. Use on heavy cuts on low tensile strength material; light and medium roughing cuts on high tensile strength material. (See note.)

GRADE XV **Hardness—Rockwell "C" 68-70**
Hardest grade. Use on light and medium cuts on low tensile strength materials and finishing cuts on high tensile strength materials.

NOTE: Grade X is the best for all around work. If grade is not specified on order we will automatically supply Grade X.

KUTKOST SOLID TOOL BIT PRICE LIST

SIZE	PRICE EACH	SIZE	PRICE EACH
1/4 x 1/4 x 2 1/4	.95	7/16 x 7/16 x 3 1/2	2.40
5/16 x 5/16 x 2 1/2	1.25	1/2 x 1/2 x 4	3.25
3/8 x 3/8 x 3	1.65	5/8 x 5/8 x 4	4.70

GENERAL TOOL & DIE CO.

555 Prospect St., East Orange, N. J.

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ANOTHER, another in the steady stream of Independent Mobile Oxygen Generators is on its way to our fighting forces... *somewhere* on the world Battle Fronts... supplying oxygen to our "*hi-flying*" air squadrons who could not leave the ground without their oxygen tanks filled. • • Independent... *first* to produce these Mobile Oxygen Generators—First Too in actual service—You'll find Independent Engineering Company *first*—after Victory —to supply *you* with equipment for producing industrial gases for peace-time pursuits.

Independent Engineering Co.—Pioneer designers and producers of Mobile Oxygen and Hydrogen generating plants for the armed forces... builders of Oxygen, Hydrogen and Acetylene plants —manufacturers of industrial gas cylinders and cylinder handling equipment.

Independent Engineering Co.

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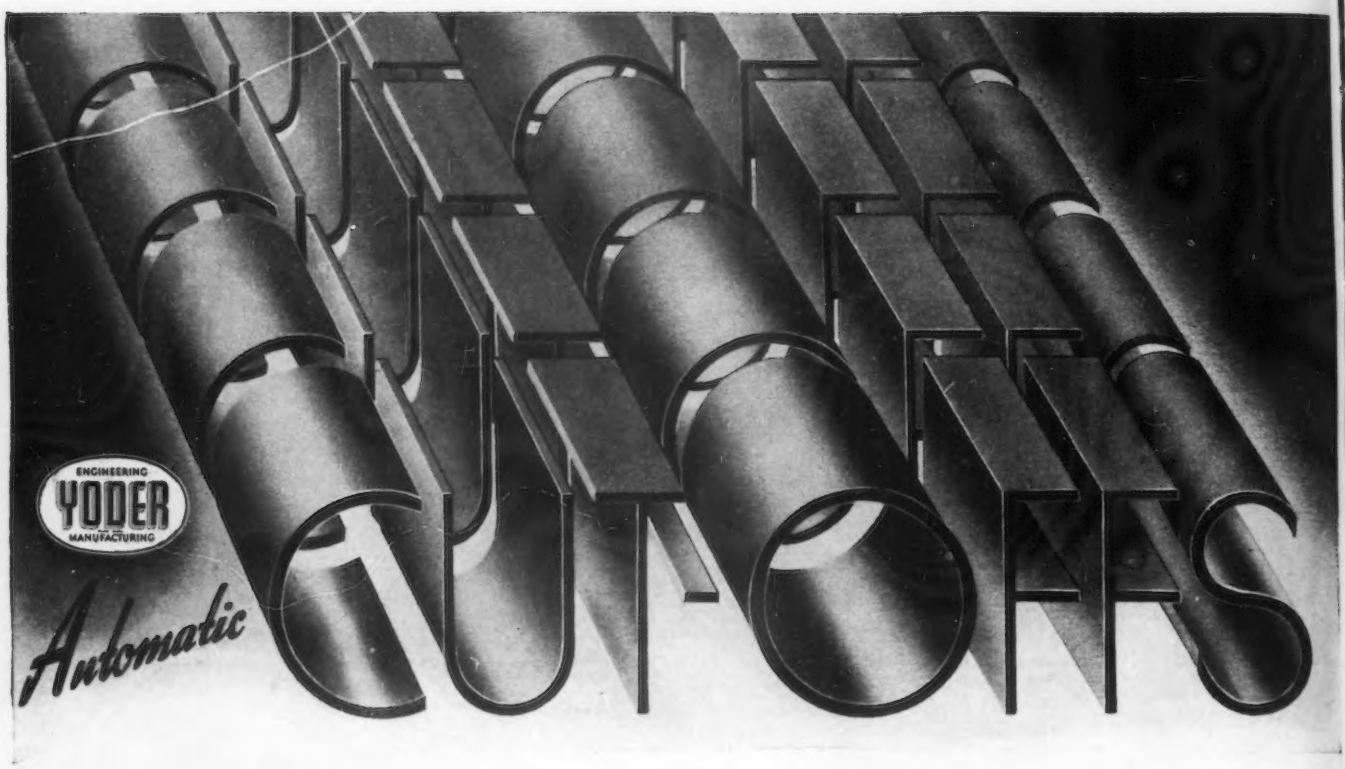
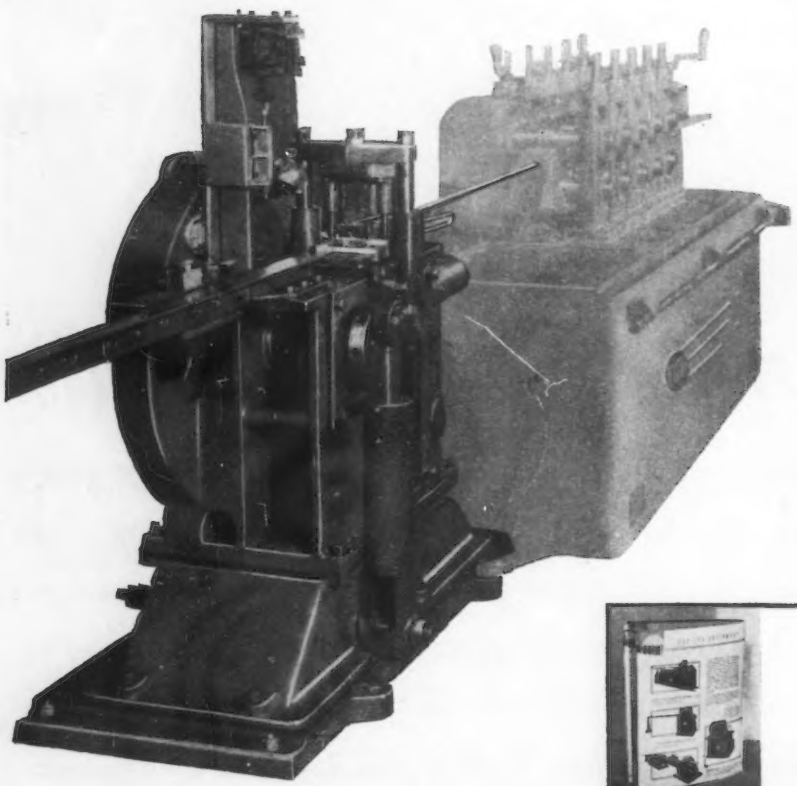




"Yoder Automatic Cut-Offs" cut off tubing, moulding, wire rods and strip metal, accurately, speedily and with a comparatively light burr. The cutting-off operation can be synchronized with the forward motion of the entire line-up of Roll-Forming, Straightening, Leveling and Welding Machines.

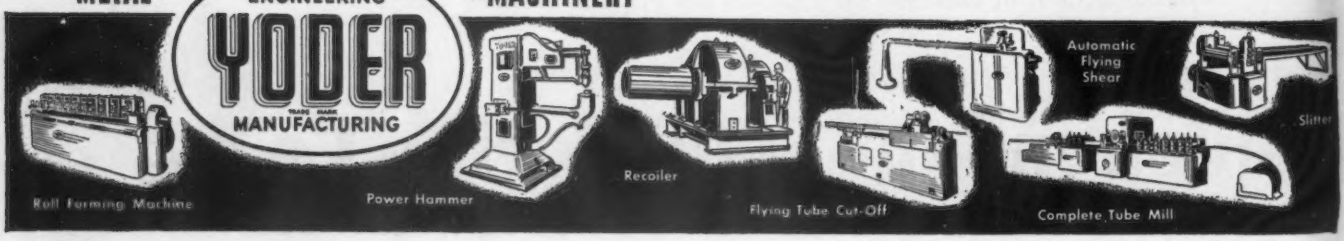
This machine stands last in the line of operations but first in the choice of necessary auxiliary equipment. For "TOTAL" quality roll-forming production, USE YODER ROLL-FORMING MACHINES AND YODER AUXILIARY EQUIPMENT.

If you write, we'll send you our new general catalogue, with a part devoted to our complete line of Cut-Off Machines. If you give us a few details, we'll send a "proposal" with prices and recommendations.

METAL • FORMING • PRODUCTION • MACHINERY

ENGINEERING YODER MANUFACTURING

THE YODER COMPANY
CLEVELAND, OHIO, U. S. A.



If "Burring"

IS YOUR PRODUCTION ENEMY No. 1—

Let Osborn Prove To You How Brushes Can Speed and Improve This Operation

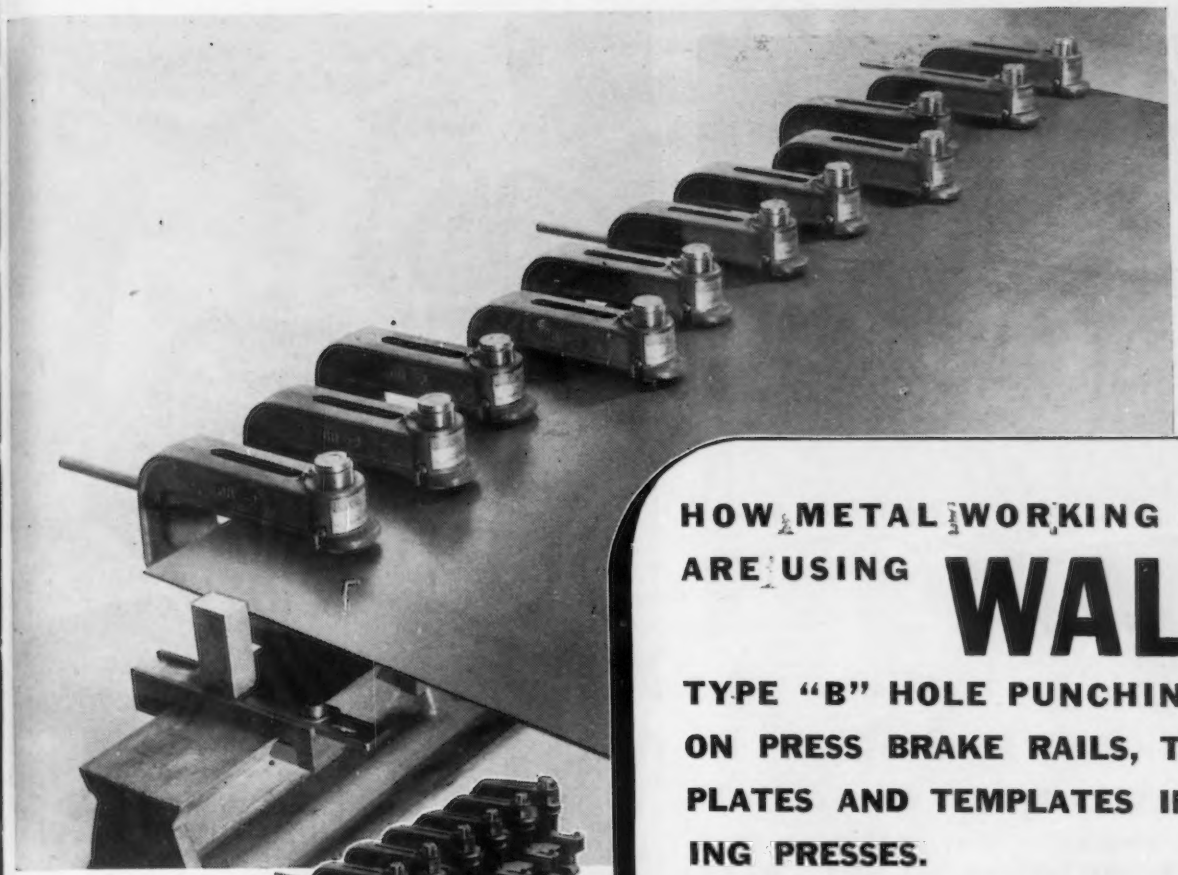
● The illustrations above show a section of a precision metal part used in a vital wartime product. Top photograph is a close-up view of one edge of this part. What looks like a mountain range around the hole are really small burrs. Below it this same area is pictured after brushing. Note the absence of any excess metal, the smooth finish and the rounded corners.

This example is typical of thousands of metal parts, large and small, going into the production of such precision products as bombs, shells, guns, recoil mechanisms and motors. Every one must be free of burrs. Every one must have the corners broken. Too frequently, both operations are being performed by slow, inefficient manual methods, with the result that an abnormal number of workers is required for this service and the finished job leaves much to be desired.

Osborn representatives are prepared to study your burring requirements and show you how the right type or types of power-driven brushes, properly applied, can speed, simplify and improve this all-important operation. Write today for complete information. *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland, Ohio.*

Osborn Brushes

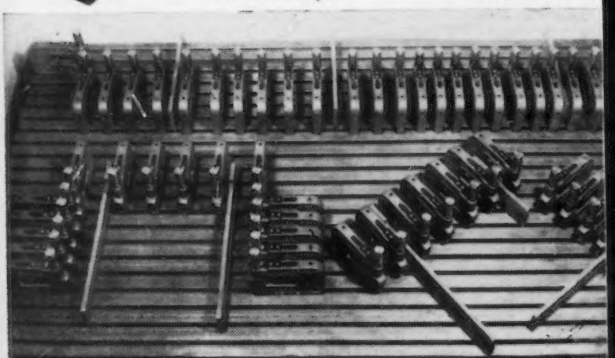
WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

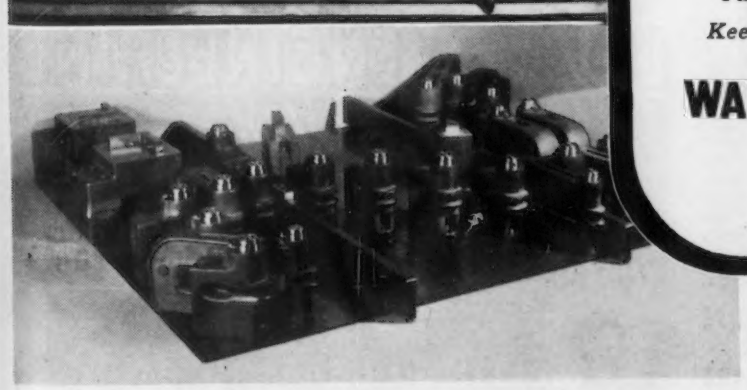


LEFT: Showing staggered pattern set-up for punching holes in sheets on press brakes.

ABOVE: Showing Wales Type "B" Hole Punching Units set up in straight line.

BELOW: Set-up of Type "B" Units on a T-slotted plate for stamping presses. Note several patterns on same set-up.





LEFT: Template set-up of Type "B" Units for stamping presses.

HOW METAL WORKING PLANTS ARE USING WALES

TYPE "B" HOLE PUNCHING UNITS ON PRESS BRAKE RAILS, T-SLOTTED PLATES AND TEMPLATES IN STAMPING PRESSES.

By unique patented design, Wales Type "B" Hole Punching Units for punching flat sheets can be used interchangeably on press brake rails, and T-slotted plates or templates in stamping presses.

Set-ups on T-slotted plates and templates are quickly made by simply bolting the units in exact position according to master pattern. Each unit is independent and self-contained with punch and die held in constant alignment by holder. This makes it possible to set the units in any location on plates. Units are easily moved or replaced in set-ups so they can be used and reused to eliminate costly "dead storage."

For press brake set-ups these units are clamped on Wales adapters which are clamped to Wales press brake rail. The adapters are designed for front to back adjustment to provide staggered as well as straight line hole patterns.

Other time-saving, money-saving features built into Wales Type "B" Hole Punching Units:—

Nothing is attached to press ram . . . punch and die holder is a self-contained unit . . . punch and die are always in perfect alignment eliminating the usual time-consuming adjustments required to line up punches and dies of conventional set-ups . . . interchangeable punches and dies to punch various sizes and shapes with same holders . . . die setting time and press "down time" are cut from hours to minutes.

"There's Always Something New in the Wales Line."

Keep posted by writing for Catalog "B" TODAY.

WALES-STRIPPIT CORPORATION

George F. Wales, President

NORTH TONAWANDA, N. Y.

Specialists in Punching and Notching Equipment

● In heat-treating carbon, alloy, and high-speed tool steels, you no longer need slow down operations to the capacity of the few experienced heat treaters available. With a Delaware Controlled Atmosphere Furnace, or a battery of these Furnaces, and the guidance of one experienced heat treater you can step up quality while using the inexperienced help of women.

Delaware Controlled Atmosphere Furnaces insure high quality results

BECAUSE: The new Delaware tangential firing method insures perfect temperature uniformity throughout the entire work area of the hearth.

BECAUSE: Its simplified atmosphere principle yields clean, scale-free, perfectly hard surfaces on all steels.

BECAUSE: With temperature automatically controlled, the heating operation consists solely in loading, timing and quenching.

If your work involves the heat-treatment of tool and alloy steels—from the simplest straight carbon type on through the various Moly high speed steels—you will be interested in the Delaware Controlled Atmosphere Furnace. Representing a development of many years of heat-treating experience, it embodies patented features which make it the most perfect heat-treating tool of its kind.

SEND FOR THIS BOOK

Fully describes the new method of heat treating that replaces human judgment with automatic control. Shows the flexibility of the Delaware Furnace. Illustrates features which simplify operations and procedure.

The book is free. Send for it now.

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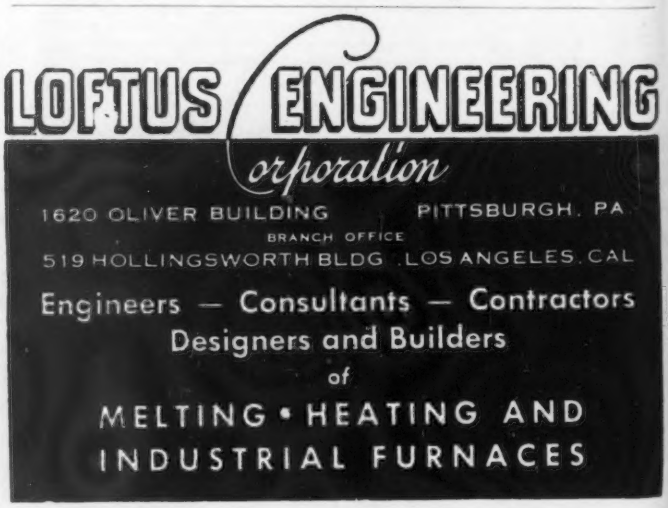
CONTROLLED ATMOSPHERE
FURNACES

DELAWARE TOOL STEEL CORPORATION
MANUFACTURERS OF FINE TOOLS SINCE 1918
WILMINGTON **DELAWARE**



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Horizontal drive, made in 35 sizes in ratios of 10 to 1200:1 and from ¾ to 75 horsepower.

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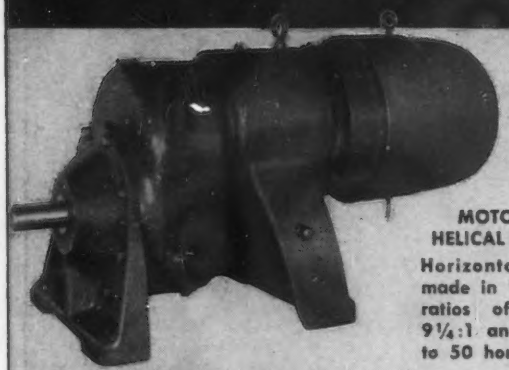

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Horizontal drive—made in 13 sizes in ratios of 1¼ to 9¼:1 and from ¾ to 50 horsepower.

ARMY E NAVY

MOTORIZED WORM GEAR REDUCER
Horizontal drive—made in 11 sizes in ratios of 6 to 80:1 and from ⅛ to 50 horsepower.

SAVE ESSENTIAL AND VALUABLE SPACE

War time requirements make the D.O.James Motorized Reducers a very important *Must* in solving and meeting the power-saving needs of modern industry. Their accessibility and compactness make them most desirable when floor space is limited. Their soundness of design and manufacture insures maximum efficiency with minimum maintenance.

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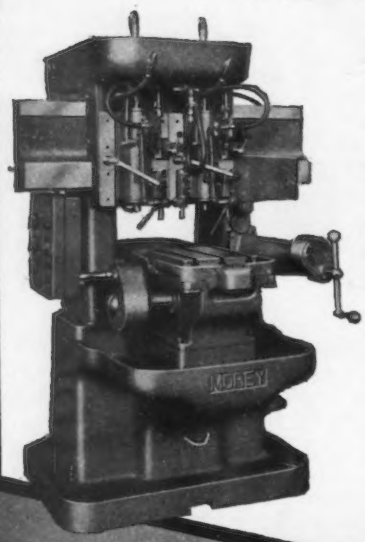
Established 1888
1140 W. Monroe Street Chicago, U. S. A.

MAKERS OF ALL TYPES OF GEARS AND GEAR REDUCERS

MOREY
DESIGNED AND BUILT
For PRECISION *Plus* PRODUCTION

MOREY VERTICAL PROFILER AND MILLING MACHINE



Over 2000 Morey Profilers in continuous service assuring speedy production for the United Nations in duplicating small parts.

Cross head is balanced on vibration-free cross rail . . . Clearance between spindle and table easily increased or decreased . . . Spindles mounted on precision bearings . . . Ball bearings throughout . . . Slides ride on scraped ways and are adjustable against future wear.

Ample provision for lubrication . . . Simple adjustment takes up backlash . . . No chatter marks on work . . . Table working surface, 12¾" x 15"

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WIRE AND METAL RIBBON
FORMING MACHINERY
NILSON TILTING
WIRE REELS
(Wire Reel Catalog No. 51)
Special Machines Designed and Built to Order
THE A. H. NILSON MACHINE COMPANY, BRIDGEPORT, CONN.

LUCAS "PRECISION"
Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.
NOW AND ALWAYS OF
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PERFORATED METALS
Screens and grilles in all commercially rolled metals, all standard and special designs
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LAST YEAR'S BONDS GOT US STARTED

THIS YEAR'S BONDS

ARE TO WIN!

★ Last year saw nearly 30,000,000 workers voluntarily buying War Bonds through some 175,000 Pay-Roll Savings Plans. And buying these War Bonds at an average rate of practically 10% of their gross pay!

This year we've got to top *all* these figures—and top them handsomely! For the swiftly accelerated purchase of War Bonds is one of the greatest services we can render to our country . . . and to our own sons . . . and our neighbors' sons. Through the mounting purchase of War Bonds we forge a more potent weapon of victory, and build stronger bulwarks for the preservation of the American way of life.

"But there's a Pay-Roll Savings Plan already running in my plant."

Sure, there is—but how long is it since *you've* done anything about it? These plans won't run without winding, any more than your watch! Check up on it today. If it doesn't show substantially more than 10% of your plant's pay-roll going into War Bonds, it needs winding!

And you're the man to wind it! Organize a vigorous drive. In just 6 days, a large airplane manufacturer increased his plant's showing from 35% of employees and 2½% of pay-roll, to 98% of employees and 12% of pay-roll. A large West Coast shipyard keeps participation jacked up to 14% of pay-roll! You can do as well, or better.

By so doing, you help your nation, you help your workers, and you also help yourself. In plant after plant, the successful working out of a Pay-Roll Savings Plan has given labor and management a common interest and a common goal. Company spirit soars. Minor misunderstandings and disputes head downward, and production swings up.

War Bonds will help us win the war, and help close the inflationary gap. And they won't stop working when victory comes! On the contrary—they will furnish a reservoir of purchasing power to help American business re-establish itself in the markets of peace. *Remember, the bond charts of today are the sales curves of tomorrow!*

You've done your bit Now do your best!

THIS SPACE IS A CONTRIBUTION TO AMERICA'S ALL-OUT WAR EFFORT BY

THE IRON AGE

THE CLEARING HOUSE

KEEP 'EM RUNNING!

Every machine listed in this column is in our warehouse at press time.

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No. 3 WARNER & SWASEY Universal Hollow Hex. Turret Lathe, 3 1/8" capacity, Belt or Motor Drive.

10' x 3/16" NIAGARA Squaring Shear.

42" PUTNAM Double End Car Wheel Lathe, M.D.

47" N.B.P. Double End Car Wheel Lathe, M.D.

6" x 6" x 5/8" Double Angle Shear.

Beam Shear 20", 60# and smaller.

60" Throat 8" x 1 1/16 Shear.

54" Throat 1 3/4" x 1 1/8" Punch.

6" BILGRIM Bevel Gear Generator.

15" GLEASON Bevel Gear Generator.

No. 9 N.B.P. Vertical Miller 32" rotary table, 4" dia. spindle, M.D.

30" x 30" x 10' NEWTON Slab Miller horizontal arbor, M.D.

52" Rotary Planer, M.D.

48" x 48" x 24' NBP Heavy Planer, Two Rail, One Side Head, Motor Drive.

48" x 48" x 20' PATCH Planer, 4 heads, 230 Volt D.C. Rev. Motor Drive.

60" NEWTON Portable Slotter, 230 Volt D.C. Rev. Motor Drive.

24" NEWTON Cold Saw, 7 1/2" capacity, M.D.

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1721 North Broadway, Albany 1, N. Y.
N. Y. Office: 149 Broadway

GEAR CUTTERS
6" Gleason Bevel Generator
36"x10" Cinci. #3A Spur
36"x10" Newark, Spur M.D.
36" G. & E. Spur & Bevel

PLANERS
36"x36"x12' Putnam, 3 hds., M.D.
36"x36"x10' Cincinnati, M.D.
27"x27"x 6' Woodward Powell
22"x22"x 5' Whitcomb

BOLT & PIPE THREADERS
16" Curtis & Curtis Pipe, M.D.
10" Saunders Pipe
10" Bignall & Keeler Pipe
3" & 1 1/2" National Bolt
2 1/2" Landis Bolt M.D.

LATHES
60"x28' New Haven Tri, Grd. with 96" pit lathe attachment
36"x16' Bridgeford Grd. Hd.,T.A.
32"x12' Pittsburgh, Q.C.G.
20"x12' Putnam, cone, T.A.
18"x8' Flather T.A., M.D.
16"x6' Flather cone, M.D.
16"x6' Simplex, removable gap

TURRET LATHES
3 1/4"x36" Cinci. Acme, Grd. Hd., bar equipped
2 1/4"x26" Cinci. Acme, cone M.D., for chucking (2)

BORING MILLS
84" Cincinnati, 2 hds., M.D., P.R.T.; 80" table

DRILLS
10' Sellers M.D.
6' Cin. Bickford pl., M.D.
4' Western pl., M.D.
8 spin. #11 Natco multi
6 spin. Baush Multi
Coulter Type A126 Automatic Diamond Borer

GRINDERS
30"x240" Landis Cyl. M.D.
24"x 96" Landis Cyl. M.D.
20"x 96" Landis Cyl. M.D.
14"x 96" Cincinnati Cyl. M.D.
12"x120" Landis Cyl. M.D.
12"x 96" Landis Cyl. M.D.
14" P. & W. Vert. Surface Type B, A.C., M.D.
No. 6 Landis Internal
24" Bridgeport Disc D.C., M.D.
20" Bridgeport Emery, M.D.

MISCELLANEOUS
BRAKE, 8' x 10 ga. Dreis & Krump, #184, Apron, A.C., M.D.
CHUCKER, #34 New Britain
DRILL SHARPENER #50 "Leyner" Ingersoll-Rand
HAMMER, 600 lb. Ryerson
KEYSEATER, #6 Catlin, 40"x5"
MILLERS, 24" Cinci. auto (2)
NIBBLER, 36" Gray 5/8" capty.
PIPE BENDER, 4" hand Watson-Stillman
PRESS, 250 ton Watson-Stillman Horiz. Hyd. Forcing, 38" between strain bars
PUNCH, 24" Pels, 1"x3/4"
PUNCH, 24" Cleve. C., 13/16"x3/4'
SHEAR, 54" H. & J. #3, 7/8" plate
SHAVER, Vertical #2 P. & W.
SAW, Band, 6" Avey Milband
SAW, 10" Nutter & Barnes
SAW. 7" Higley #14
SLOTTERS, 17", 13" & 10"

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14"x19" Fay automatic lathe
No. 6A Potter & Johnston
1" Cleveland Model J double end
1 5/8", No. 55 National Acme
4 1/2" Gridley Model H chucker
7" Baird 6 spindle chucker
No. 16 Gridley Simplimatic

GEAR MACHINERY
Nos. 61 & 624 Fellows
No. 16 HS Gould & Eberhardt hobbers
No. 1 Lees Bradner hobbers
No. 12 Barber Colman hobbers
24"x12" Flather auto. spur
26"x 8" Brown & Sharpe auto. spur
36"x 6" Gould & Eberhardt auto. spur
48"x10" Brown & Sharpe auto. spur
15" Gleason spiral bevel pinion roughers
15" Gleason spiral bevel gear roughers
18" Gleason bevel testers & lappers
Lipe 2 spindle chamferer
Ingle tooth rounder
Model B National gear cutter checker

LATHES
8" Sundstrand Stub
1"x18" Pratt & Whitney automatic
3 1/2"x36" Lo Swing
4"x36" Lo Swing
9"x14" Porter Cable
13"x6' Automatic threading
14"x6' Lodge & Shipley, turret on carriage
22"x10' American engine turret on ways
Melling crankshaft lathe
36"x16' Putnam geared head

LATHES TURRET
3"x36" Jones & Lamson
22" and 26" Libby geared head universal, 4 1/8" hole
24" Gisholt universal, 6 1/4" hole
28" Steinle geared head universal, 8" hole, 80" between chuck & turret faces

MILLERS
Type C Hall planetary thread
Taft Peirce thread miller
Types 10 & 45 Productomatic
No. 1 Davis & Thompson duplex
No. 3 Turnmillers
28" Cincinnati duplex
36" Garvin cam miller
48" Ohio (Oesterlein) tilted offset
No. 4 Cincinnati plain
3 5/8" dia. bar Beaman & Smith horiz. mill or cyl. borer

PLANERS
24"x24"x5' Gray
24"x24"x6' Woodward & Powell
29"x29"x6'3" New Haven
56"x56"x28' Hamilton

RIVETERS
No. 103 Grant spinner
Nos. 2A hg., 5 1/2 B & 7B High Speed

SHAPERS
24" Gould & Eberhardt
36" Morton draw cut

SHEARS
No. 180 Tessmer sprue cutter
1 1/2" Lewis alligator
1 3/4" No. 1 Hilles & Jones alligator
2" Newbald guillotine
8"x8"x1" Long & Alstatter angle iron

SWAGER
No. 6HS Langelier

TAPPERS
No. 1 Garvin
1" & 1 1/2" National 6 spdl. nut
Natco one and two way horiz.

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1/4"x2" Waterbury Farrel thread roller
3/4" Economy type R auto. stud threader
3/4" Landis bolt
1" Cleveland Model J, double end for threading, drilling, pointing and turning
2" Landis 2 spdl. bolt
2" Landis 2 spdl. pipe & nipple threader
2" Rogaco pipe threader

UPSETTERS & FORGING ROLLS
2" National steel frame
4" Ajax steel frame
No. 1A Ajax taper forging rolls

MISCELLANEOUS
Borer, Houde with Excello heads
Brake, 10' Ohl 255 ton capy. press brake
Buffer, Divine polisher.
Drills, H2 & H3 Barnes Hydrau.
Grinder, No. 2 Cincinnati centerless
Hammer, 100 lb. Bradley helve
Nut Driver, Bodine No. 61AA
Roll, No. 60 Yoder fender crown
Screw Driver, Model C Detroit
Spring Coiler, 5/8" No. 5 Sleeper & Hartley

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MILES MACHINERY CO.
Saginaw, Mich.

THE CLEARING HOUSE

MOREY

Dependable Used Machines

BULLARD 24″ R. P. Vertical Turret Lathe with Side Head

G & E 48″ Gear Cutter

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GLEASON 6″-18″ Bevel Gear Gen.

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100 ASSORTED MILLING MACHINE ATTACHMENTS

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P & W No. 12 Multi-Spindle Drill

POTTER & JOHNSTON No. 6C Semi-Automatic

NATCO C-13 Hyd. Multiple Spindle Drill

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ACME 1″ All Steel Upsetter

SAUNDERS 8″-18″ Pipe Threader

TREADWELL 12″ Pipe Machine

GISHOLT Precision Balancing Machine

LONG & ALLSTATTER Angle Shears

AMERICAN 30″ x 30″ x 14′ Planer 2 heads, M. D.

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410 BROOME ST. NEW YORK

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21″ Cross Gear Tooth Rounder, m.d.
90″ Gould & Eberhardt Gear Cutter
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No. 3—26″ Cincinnati Gear Cutter
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No. 3—26″, 3—36″, and 3 Heavy Brown & Sharpe Spur
No. 4—36″ and 4—48″ Brown & Sharpe Spur
No. 6—60″ and 6—72″ Brown & Sharpe Spur
No. 5 Lees-Bradner Gear Generator, 14″ size
No. 12 Barber-Colman Gear Hobbers, m.d.
No. 36BM 3 spindle Gould & Eberhardt Gear Rougher
Gleason Spiral Bevel Gear Rougher
12″ Ingle Gear Tooth Rounder

GRINDERS

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No. 50 Heald Cylinder Grinder, hydraulic feed
No. 55, 60, 65 Heald Cylinders, mechanical feed
No. 10, 29 Bryant Internal
No. 71 Heald Internal, m.d.
No. 20 Gardner B.B. Comb. Disc Grinder and Roll Sander, m.d.
No. 1 Fraser Lapper, 26″ plate
No. 2 Diamond Auto. Surface, m.d.
14″ Pratt & Whitney Vertical Surface, m.d., ball bearing
Walker Single Stroke Surface, 10″ chuck
54″ Bridgeport Knife, m.d.
Gisholt Universal Tool, belt
Gleason Cutter, belt
Landis Chaser, belt
Gould & Eberhardt Gear Cutter, belt
3″ Sellers Drill, belt
2 and 3 H.P. New Baldor Emery—in stock
5 H.P. New U.S. in stock
No. 1, 6 Blount Emery
No. 6 Ransom Emery
5 H.P. Northern Polishing Stand, d.c.
Safety Emery Wheel, belt
U. S. Polishing Stand, m.d.
M7 1 H.P. Strand Flexible Shaft, 440 v.

HORIZONTAL DRILLS

No. 00S Garvin Horizontal Duplex
Love Bros. Horizontal, No. 4 Taper
Pratt & Whitney Rifling Machine
No. 1 Pratt & Whitney 2 spindle Gun Barrel, m.d.
5 spindle Detroit Semi-Automatic
6 spindle National Acme Automatic
8 spindle Hammond Horizontal, m.d., hydraulic

UPRIGHT DRILLS

10, 12″ Barr
20″ Barnel Camel Back
22″, 24″ Aurora
23″ Barnes All Geared Self-Oiling
24″ Cincinnati
24″ Hoefer
24″ Milwaukee
25″ Fosdick, box column
30″ Rich Heavy Duty
36″ Prentice

BALL BEARING DRILLS

No. 5BM Fosdick latest type
1 spindle Allen
No. 2, 3 Avey
Automatic Sensitive, m.d.
1 spindle Leland & Gifford, p.f.
Taylor & Fenn, No. 2
1 spindle Henry & Wright
2 spindle Sigourney
3 spindle Barr
3 spindle Kokomo No. 3
4 spindle 13″ Fosdick Super Speed
4 spindle Gardam
4 spindle No. 2 Fosdick, p.f.
4 spindle Kokomo No. 3
6 spindle Henry & Wright No. 2
7 spindle Barr

MULTIPLE SPINDLE DRILLS

3 spindle Rockford 12″ Gang
4 spindle Harrington H.D. Rail
No. 1 Baush, rect. head m.d. (5 in stock)
No. 2 Baush, 16x30″ rect. head, m.d., tapping
No. 2 Baush, 16x30″ rect. head, hydraulic feed, m.d. (3 in stock)
No. 2 Baush, 16x30″ rect. head, mech. feed
No. 3 Baush, 16x30″ rect. head, m.d. (3 in stock)
No. 11 Pratt & Whitney, 14x9″ head
No. 22AC Fox, 16″ round head
No. 26C Fox Tapper, 50 spindles, No. 1

Many other machines available for immediate shipment. Let us quote.

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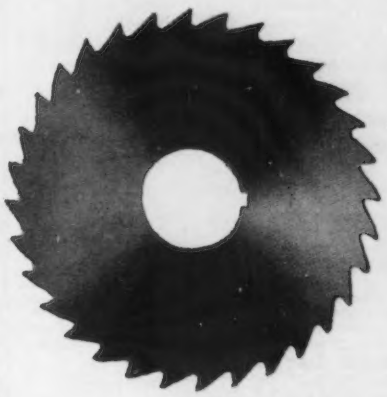
PROMPT DELIVERY

NEW HIGH SPEED SLITTING SAWS



THESE SAWS ARE HOLLOW GROUND

Dia.	Width	Hole	Our Price Net Each High Speed
2½	1/32	⅞	$1.68
2½	3/64	⅞	1.68
2½	1/16	⅞	1.68
2½	3/32	⅞	1.68
2½	⅛	⅞	1.68
3	1/32	1	1.98
3	3/64	1	1.98
3	1/16	1	2.04
3	3/32	1	2.04
3	⅛	1	2.10
3	5/32	1	2.20
4	1/32	1	2.58
4	3/64	1	2.64
4	1/16	1	2.70
4	3/32	1	2.82
4	⅛	1	3.00
4	5/32	1	3.12
4	3/16	1	3.30
5	1/16	1	3.48
5	3/32	1	3.78
5	⅛	1—1¼	3.96
5	5/32	1—1¼	4.20
5	3/16	1—1¼	4.44
6	1/16	1	4.38
6	3/32	1	5.02
6	⅛	1—1¼	5.16
6	3/16	1—1¼	6.24
8	1/16	1	10.00
8	⅛	1—1¼	10.50
8	3/16	1—1¼	11.88

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MACHINERY EXCHANGE, INC.
251 Centre St., New York, N. Y.
Phone: CAnal 6-5575

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CONSIDER GOOD USED EQUIPMENT FIRST

AIR COMPRESSOR
1721 cu. ft. Ingersoll-Rand Class PRE2, M.D. 232 H.P. Motor 4000/3/25, 100# Pressure

BRAKES—PRESS TYPE
8'6" Ohl Press Brake, B.M.D. #10 Gauge
10'6" Ohl Press Brake, B.M.D. #11 Gauge

CRANES—OVERHEAD ELECTRIC TRAVELING

2 ton Euclid	40' Span,	440/3/60 A.C.
3 ton Shepard	35'4" Span,	110 Volt D.C.
5 ton Shaw	9'6" Span,	220/3/60 A.C.
5 ton P & H	33' Span,	220 Volt D.C.
5 ton Champion	37'6" Span,	550/3/60 A.C.
5 ton Browning	46'8" Span,	220/3/60 A.C.
7½ ton Niles	40' Span,	220 Volt D.C.
7½ ton Shepard	36' Span,	230 Volt D.C.
20 ton Niles	33' Span,	220 Volt D.C.
20 ton Niles	50' Span,	230 Volt D.C.
25 ton Sellers	58'3" Span,	220 Volt D.C.

CRANE—RUNWAY
271' Runway "A" Frame Outdoor Type
780' Runway "A" Frame Outdoor Type (NEW)

CHARGING MACHINE
5 ton Wellman Seaver Open Hearth Charging Machine. Complete with Motors

DIE SINKING MACHINE
Type F Keller Automatic Die Sinking Machine Incl. Elecl. Equipment. Actual travel or surface cut over 36" long x 20" wide; Depth of cut 8"; Working Surface 53" x 28½". All three motions effected by magnetic clutches

FURNACES
Model 701 Rockwell Revolving Annealing Furnace. Capacity per hr. 300 lbs. Effective Heating Length 5'3"
500 KW Ferro-Enamel Continuous Type Electric Heat Treating Furnace, designed for 440/3/60

FORGING MACHINES
Ajax, National, Acme—Various Sizes

GEAR REDUCTION UNITS
500 H.P. Falk Double Reduction Gear Unit. Ratio 18.6 to 1
1500 H.P. Falk Gear Reduction Unit and 1500 H.P. Allis-Chalmers Motor 2200 volt, 3 ph., 60 cycle, 236 R.P.M.
300 H.P. 2200 volt, 3 phase, 60 cycle General Electric Slip-Ring A.C. Motor and Double Reduction Gear Unit

2 TON OVERHEAD ELECTRIC TRAVELING CRANE 38' 6" SPAN
Complete with three 230 Volt D.C. Westinghouse Motors

800 TON MESTA STEAM HYDRAULIC FOUR COLUMN FORGING PRESS
Distance Between Columns RtoL x FtoB.. 6'x2'9"
Maximum Opening under Top Platen.... 7'2½"
Maximum Opening Between Upper Face of Lower Die Block and Lower Face of Upper Die Block ..... 40"

HAMMERS—STEAM FORGING

600# Morgan	
600# Chambersburg	— Single Frame
800# Niles-Bement-Pond	— Single Frame
1000# Chambersburg	— Double Frame
1100# Bement Niles	— Single Frame
1100# Chambersburg	— Single Frame
1100# Erie	— Single Frame
1500# Niles-Bement-Pond	— Single Frame

HAMMERS—STEAM DROP
800# Erie
1500# Alliance, Three "V" Slides

LEVELLER—ROLLER
75" Torrington Roller Leveller 19 Rolls 2" Dia. Motor Driven. Capacity # .060 Gauge

PRESSES—STRAIGHT SIDE SINGLE ACTING
No 158B Cleveland, Arr. M.D. 16" Stroke, Bed Area 48½"x73". Tie Rod Construction
No. 5 Bliss Consolidated, 3" Stroke, Bed Area 22"x32"
No. 56DG Ferracute, B.D. 10" Stroke. Distance Between Uprights 28"

PUNCH—MULTIPLE
No. 42 Williams & White Gang Punch, 3" Stroke. 14'4" Between Uprights, 175 ton Capacity

PUNCH & SHEAR COMBINATIONS
18" Throat Beatty #10½ Punch & Shear, Single End, M.D. Cap. Punch 2½" hole thru 1½"
36" Throat Cleveland Style "EF" Punch & Shear, Single End. Cap. Punch 1" thru 1¼". Shear 1". Attachments for Punching, Shearing, Angle Shearing & Plate Bending
36" Throat Long & Alstatter #3 Punch & Shear, Single End, M.D. Cap. Punch ⅞" thru ⅞"
15" Throat Whiting #6 Punch & Shear, Single End, M.D. Cap. Punch ¾" thru ¾"

ROLL FORMING MACHINE
Type 3-F McKinney Roll Forming Machine. 6 Stand — Widest Sheet Rolled 15". Capacity 10 gauge to ¼"

ROLL—PLATE STRAIGHTENING
72" Hilles & Jones #2 Plate Straightening Roll, B.D. or Motorized. Six 10" Diameter Rolls

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8"x5" Broden Single Stand Two High
9" Lewis Belgian Type Rolling Train with Pinions, Couplings and Spindles
10"x12" United E & F Co. Single Stand Two High
11"x24" Newbold Single Stand Two High—M.D.
12" Merchant Mill—3 High
14"x15" Hoagland Strip Mill Single Stand Two High
16"x36" Single Stand Two High—M.D.
16" Garrison 2-High 2-Stand
26" Mesta Cold Sheetmill Roll Train—M.D.
29" Mesta Hot Sheetmill Roll Train—M.D.
30" United Eng. & Foundry Co. 3-High Sheet Bar Mill

SAWS
48" United Eng. & Foundry Co. Sliding Frame Hot Saw. Arr. M.D. Stroke 4'6"
8"x16" Kalamazoo Metal Cutting Band Saw, M.D.

SHEAR—ALLIGATOR
No. 6R United Eng. & Foundry Co. Alligator Shear, B.D. Approx. Capacity 6"
Canton Alligator Shear, Motor Driven. Approx. Capacity 3"

SHEAR—ANGLE
6"x6"x1" Cleveland #4 Double Angle Shear. Motor Driven

SLITTER
G-48 Yoder Slitter, Motor Driven. Capacity 48" wide sheets, 11 Ga. & Lighter

TESTING MACHINE
200,000 lb. Olsen Hydraulic Compression Testing Machine, Complete with Pump and Motor

WIRE MACHINERY
24" Morgan Six Block Wire Drawing Machine, M.D. Capacity ½" Diameter. Complete with wire pointer, wire reels, wire strippers and wire tie up benches

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NEW YORK CITY

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Surplus Mfg. Equipment Inventories Purchased

LATHES
14"x8' Mulliner—cone

GEAR MACHINERY
24H Gould & Eberhardt Gear Hobber, M.D.
9" Pratt & Whitney Gear Grinder, M.D.
11" Gleason Bevel Gear Generator
Cimatool Gear Chamfering, M.D.
Lees-Bradner Gear Grinder

TURRET LATHES
Goss & DeLeeuw 6"x6¾"

MISCELLANEOUS
8" Bullard Multimatic M.D.
36"x36"x8' Woodward & Powell Planer Rev. M.D.
Lees-Bradner Thread Miller 60"
2" P & W Duplex Spline Miller
21—SA Cochrane-Bly H.S. Saw
#107 Grant Rivet Spinner
#171 Bliss Stiles Sprue Cutter

DRILLS
4 Spindle Taylor & Fenn, M.D.

WIGGLESWORTH MACHINERY CO.
195 Bent St., Cambridge, Mass.

Boring Mill, Bullard 30", motorized.
Lathe, Hendey 18" x 12', Q.C., G.H., taper, Mot.
Radial Drill 3' Carlton.
Lathe, Prentice 16" x 6', Q.C., Mot.
Grinder, Norton Cylindrical 10" x 18"
Planer, Pond 30"x30"x8', 2 heads, H.D.
Turret Lathe, Gisholt 3½", Univ.
Turret Lathe, P & J 1½", gear box drive.

KINGS COUNTY MACHINERY EXCHANGE
394 Atlantic Avenue **Brooklyn, N. Y.**

MILLING MACHINES
#1 Lambert-Heald, plain, motor in base
#1 Cincinnati, universal
#2 Milwaukee, plain
#4 Becker, vertical

TURRET LATHES
1½" Pratt & Whitney, power and bar feeds
1 7/16" Acme, power and bar feeds
1⅞" Smurr & Kamen, power and bar feeds
24" Conradson, fully automatic
2¼"x24" & 3"x36" Jones & Lamson

LATHES
14"x 6' LeBlond quick change g.b.
18"x 8' American Tool, motor., taper att., q.c.g.
20"x8' LeBlond, q.c.g., M.D.
20"x12' Lodge & Shipley
26"x10' Bridgeford, q.c.g., taper attach.

NEW 6" x 18" SURFACE GRINDERS MOTOR IN BASE

GRAHAM MACHINE TOOL, INC.
231 CENTRE STREET **NEW YORK CITY**
TEL.: WOrth 4-8125-6

10' Niles Vertical Boring Mill
54" Colburn Vertical Boring Mill, M.D.
1⅜", 2¼" Gridley 4 spindle, M.D.
1", 2¼" Nat-Acme 4 spindle
2¼", 4¼" Gridley sgl. spdl.

PLANERS
24x24"x6' Flather, 1 head
24x24"x6' Whitcomb, 2 heads
32x32"x10' Pond, 1 head
30x30"x8' Gray, 1 head
36x36"x12' Niles, 1 head.

CANAL MACHINERY CO.
176 LAFAYETTE STREET NEW YORK, N. Y.

30"x22' Lodge & Shipley Lathe, QCG, M.D.
4½" Niles Horiz. Boring Mill, floor type, M.D.
60x60x12' Gray Planer, 4 hds, M.D.
14"x72" Norton Cylindrical Grinder, M.D.
36" Bullard Boring Mill, M.D.
300 ton United Steam Hydr. Forging Press
1,600 ton Hydraulic Press, complete
Horizontal Punch #3 H & J 1 3/16" thro 1⅛"
48" W-W Punch #14½ 1" thro 1"

W. E. BRANDT
MACHINERY SALES
513 Empire Bldg. **Pittsburgh, Pa.**

Boring Mills, 24" & 42" Bullard.
Grinder, Face 10' Bridgeport, M.D.
Grinder, roll 30"x76" Farrel, M.D.
Lathe, 26"x14' Bridgeford, Grd. Hd.
Shaper, Draw Cut 36" Morton.
Shear, Rotary ¾" Newbold, 50" cap.
Shear, 44"x3/16" American.
Straightener, 54"—17 rolls—4¼" dia. M.D.
Straightener, 48"—17 rolls—4" dia. M.D.
WEST PENN MACHINERY COMPANY
1210 House Bldg., Pittsburgh, Pa.

1" NATIONAL VERTICAL TYPE ROLL THREADER
Like new. Bought late in 1940.
May be inspected; still set up.
J. L. LUCAS & SON, INC.
Bridgeport, Connecticut

Milwaukee Face Mill Grinder
72" x 36" x 10' table Ingersoll Mill
Gridley four-spindle Model H Chucking Machines, M.D.

D. E. DONY MACHINERY CO.
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THE CLEARING HOUSE

OTT MACHINERY SPECIALS

Automatics, BROWN & SHARPE #00G.
Automatics, CLEVELAND, ⅞, 1¼, 2 & 2½" Mod. B.
Automatics, GRIDLEY, 2¼, 3¼ & 4¼" S.S.
Automatics, POTTER & JOHNSTON #5A & 6A.
Gear Hobbers, 12 BARBER-COLMAN.
Gear Shapers, FELLOWS #7 High Speed, M.D.
Grinders, BLANCHARD, #16A, M.D. 30" Mag. Chuck, Dial Loading.
Grinders, HEALD, R.S. 12" Mag. Chuck.
Grinders, BRYANT #5, 15 & 18 Internal.
Grinders, LANDIS, 6 x 18" & 10 x 36" M.D.
Milling Machines, BECKER Vertical, Model C, 30" Rotary Table.
Milling Machines, BECKER Vertical, Model 5D, 40" Rotary Table.
Presses, TOLEDO, #34, Solid Back, Geared.
Presses, NIAGARA #77B Dble. Crank.

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IMMEDIATE DELIVERY

27" x 18' L. & S.
Geared Head Engine Lathe

KAMIS ENGINEERING COMPANY
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4½" BAR N. B. P.

Horizontal Boring, Drilling & Milling Machine, Motor Drive, Duplex Control, Table Type with Table 33"x60". Will bore to the center of 72".

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Cincinnati 30x30x14' motor drive—2 heads
Cleveland 36x36x8' — open side—2 heads on rail, one side head
Pond 60x60x12'—2 heads
Putnam 24x24x6'

DONAHUE STEEL PRODUCTS CO.
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G & E 24" B.G., gear box, rebuilt.
G & E 20" B.G., cts., rebuilt.
Cincinnati 16" B.G., cts., rebuilt.
Davis 15", cts., rebuilt.
Lodge & Davis 24", cts.

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HYDRAULIC PRESS

1000 ton Hydraulic Press built by R. D. Wood Company, up-moving type, 6 posts, platen 42" x 108", stroke 18", daylight space 36", complete with water tank, high pressure piping, gauges, valves, fittings, accumulator, intensifier, pump, 50 H.P motor and compensator. Was used on forming propeller blades. A-1 condition.

ANGLE SHEAR, 6"x6"x1" L&A, M.D.
BORING MILL, 84" N.B.P., R.P.T., M.D.
GEAR PLANERS, Bevel 36" & 54" Gleason
HAMMER, Steam Forging 1100 lb. N-B-P
MILLER, Plain, No. 1 Cincinnati, M.D.
PLANER, 30"x30"x6' Gray, two heads, B.D.
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PRESS, D.C. No. 95-B Toledo, 55"x54"
PRESS, Toggle, No. 3 Bliss, 50 ton
PRESS, Toggle, No. 14 Bliss, 350 ton
PUNCH, No. 14 W&W, 1¼"-1", thrt. 42"
PUNCH, 3-A Royersford, 1"-¾", throat 10"
SHEAR, Squar. 44"x3/16" American, M.D.
SHEAR, Squar. 54"x3/16" American, M.D.
SHEAR, Squar. 60"x¼" L&A, M.D.
SHEAR, Squar. 12'x¼" Stamco, M.D.
SHEET OILER, 72" Aetna-Standard, M.D.
SLOTTER, Portable 48" Morton, M.D.
STRAIGHTENER, Tube Torrington, ⅝" O.D.
STRAIGHTENER, Plate H & J, 84"x¼"
STRAIGHTENER, Newbold 48" x 16 ga.
TURRET LATHE, 34" Gisholt, H.S. 4¼"
TURRET LATHE, 3-A W & S, H.S. 3¾", M.D.
TURRET LATHE, 27" Libby, H.S. 7½", M.D.

LANG MACHINERY COMPANY
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HIGH SPEED PRESSES

50-ton Henry & Wright, with double roll feed less scrap cutter

No. 2 Waterbury Farrel, 40 ton, with double roll feed and scrap cutter

No. 675 Bliss, 75-110 ton, with motor, double roll feed, scrap cutter, motor driven stock straightener with Reeves vari drive

15-ton Belgian, with double roll feed

J. N. MOYER
471 N. 5th St. Phila., 23, Pa.

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1—Elmes 600 ton Hobbing Press, 18" ram, 10 stroke
1—Elmes 1⅛"x4" Horiz. 4 plunger pump, 6½ GPM, 5000# W.P.
1—W-F 1000 ton press, 20" ram, 7" stroke
1—W-F High-Low Pump 60 GPM at 300# W.P., 3 GPM at 65 High W.P.
1—500 ton press, 15" ram, 16" stroke, 28x34" platen
1—Triplex Pump 1x5, 1000 cu. in., 6000# W.P.

AARON MACHINERY CO.
45 CROSBY STREET NEW YORK, N. Y.

Toledo 92B DBL. Crank straight side press.
Production Machine Co. #101 Polishing Machine, for round bars.
53 Ton ¼ x ⅞ x 112⅛" Rd. Edge CR Steel.

A. S. CAMPBELL CO., INC.
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FOR SALE
#36 Spindle New Britain Automatic & Chucking Machine.
Good condition.
STONITE PRODUCTS COMPANY
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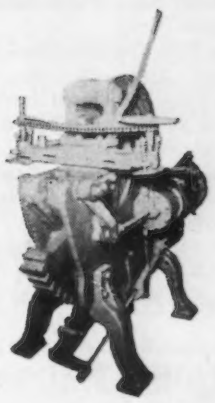
FLANGING MACHINE



McCABE PNEUMATIC FLANGER

Capacity ½" x 6".
Diameter of air cylinder 10".
Stroke 20".

This machine is available for immediate delivery and may be inspected at our Chicago warehouse.

LOUIS E. EMERMAN & CO.
Machinery
875 W. 120th St. Chicago, Ill.

AUTOMATIC

#6A Potter & Johnston Automatic Chucking & Turning Machine; M.D.

SUN MACHINERY COMPANY
36 Van Vechten St. Newark, N. J.

#1½ National Maxipress

New in 1941. May be inspected still set up.

J. L. LUCAS & SON, INC.
Bridgeport, Connecticut

POWER PRESSES

BLISS TOLEDO V & O ETC
REBUILT - GUARANTEED

JOSEPH HYMAN & SONS
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THE CLEARING HOUSE

10,000 lb. N.B. Dbl. Frame Steam Forg. Hammer
Single Frame Steam Forg. Hammers—250, 600, 1100, 1500 lbs.
Double Frame 1500 lbs.
Bradley Hammers—all sizes
#97 Toledo S.S. 900-ton Press, table 36x103"
5" National Heavy Duty Upsetter, steel frame-susp. slides
Upsetting & Forging Machines—¾" to 5"
Single and Double End Punches—wide variety caps. and Throat depths
#203 D. & K. Power Bending Brake, cap. 10' 12 ga.
#2-L LaPointe Horiz. Hydr. Broach
Swaging Machines—#6 Langelier & #312 Etna Hydr. Feed—cap. 3"
#H-520 Yoder 5 stand Cold Forming Mills
W.F. Double Bullblock—cap. ½"
Tensile Testing Machine, 50,000 lb. cap.—M.D.
Kutscheid Squaring Shear 8' 10 ga.
Detroit LFA Rocking Type Electric Furnace —350 lbs.
Wire Straighteners ½", ⅝", ¾"
Bolt, Nut & Rivet Machinery

DONAHUE STEEL PRODUCTS CO.
74TH & ASHLAND AVE., CHICAGO, ILL.

DOUBLE ANGLE SHEARS

#5 H & J cap. 8x8x1¼", turn-table, M.D.
#3 H & J cap. 6x6x1"
Brake—10'x10 ga. Ohl, Press Type
Bulldozer—#7 Ajax, 20" stroke
Compressors—400' MD & 960' Worthington
Die Sinker—#2 P & W
Forging Mach.—1½" Acme & 3" Ajax
Forging Mach.—4" Acme, Steel bed, M.D.
Gear Shaper—#6 Fellows, 36"
Grinders—Landis Cylindrical 10x24", & 12x42"
Grinder—Diamond Face, table 19"x90"
Grinder—Roll, Farrel, cap. 28"x164"
Hammers—200 lb. Bradley Helve & Upright
Hammers—1600 lb. B&S Board Drop & 500 lb.
Hammer—1600 lb. Alliance Steam Drop
Lathes—22"x12' L. & Davis, & 60"x21' N. Haven
Mult-au-matic—12" Bullard, 6 spindles
PRESSES—large Double Crank, S.S.
#158-B Cleveland, 16" stroke, bed 48"x72", 11¼" shaft at crank, M.D.
Ferracute, 4" & 12" stroke, bed 30"x122"
Press—W-Farrel, O.B. 2" stroke, bed 22"x13"
Punches—48" W-White, 1" thru 1" & 36" Bertsch
Punches—30" Cleve. & #7 Beatty, 42" M.D.
Punch—Horizontal #3 H&J 12" thrt., 1⅛ thru 1⅜
Saws—Newton Cold, 22", 48" & 62" blades
Shear—11'x16 ga. under drive
Shears—Alligator, United, cap. 6½" & 2¾" sq.
Shear—Splitting, 6'x¾" Marshalltown
Shears—Bevel, Lennox, ¾" & 1" cap.
Straightening Mach.—4½" cap. Brightman; #4 K&R, 2" & ⅝"x20' Shuster

W. E. BRANDT, Machinery Sales
Phone COurt 2103
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BOILERS

1—2750 H.P. Badenhausen water tube, Code #350
2—500 H.P. B & W Sectional Header, Code #200
1—400 H.P. Edgemoor Box Header, Code #200
8—400 H.P. Sterling 4-Drum Type, Code #200
4—200 H.P. Scotch—Wet Back—Marine #160
1—165 H.P. Scotch—Wet Back—Marine #200

Other types and sizes.

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Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DeWITT TOOL COMPANY
173 Grand St. New York City

FOR SALE

Slightly used 50 K W, 208 volt, 3 phase, 60 cycle box type furnace equipped with removable nickel chrome, sealed retort 30" wide x 36" deep x 12" high for bright annealing, including Leeds & Northrup recorder controller and ammonia cracking unit. Suitable for all the purposes of a box type furnace as well as for bright annealing.

Used "oven type" gas furnace, No. 67 American Gas Furnace Company, with inside dimensions 34" wide x 22" high x 72" deep, including 2 gas pressure boosters.

AMERICAN BANK NOTE COMPANY
Garrison Avenue and Tiffany Street
NEW YORK, N. Y.

FOR SALE

BOILERS — BOILERS — BOILERS
2—400 H.P. Sterling
1—500 H.P. Sterling
4—200 H.P.—H.R.T. Erie City
2—133 H.P. B & W Sterling
1—6 Retort Taylor Stoker
1—Cochrane Open Feed Water Heater

HETZ CONSTRUCTION COMPANY
Warren, Ohio Phone — 4474

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150 H.P. BOILER

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500 H.P. AC—1150 RPM
250 H.P. G.E. 240 RPM (2)
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60 H.P. G.E., 1800 RPM
50 H.P. Allis Ca., 720 RPM
50 H.P. G.E., 720 RPM
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1— 800	G.E.	MPC	600	600
2— 625	G.E.	MPC	500	130
1— 600	G.E.	MPC	600	650/900
1— 600	Whse		250	150/275
1— 350	G.E.	MPC	230	450
3— 300	G.E.	DMC	230	400/600
1— 300	Cr. Wh.	CMC	230	1150
1— 300	G.E.	MPC	230	275/550
1— 270	Whse.		500	250/400
1— 250	Al. Ch.		230	525
2— 200	Whse.		230	400
1— 175	Whse.	SK	250	150/525
7— 150	G.E.	RC-19A	230	800/1000
2— 150	Whse.	SK-201	230	300/900
1— 150	G.E.	MPC	230	250/450
2— 125	G.E.	CO-1832	230	625
3— 120	Whse.	SK-180	230	720
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Primary 3 Phase 60 Cycle

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1—500 KW Whse., 900 R.P.M., D.C. 250 V., A.C. 6600/2200 V.
1—500 KW Whse., 1200 R.P.M., D.C. 600 V., A.C. 2300 V.
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How accurate is it?
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Who is using "gear-shaving" today?
How many machine types and sizes are there?
How big a gear can be finished by "shaving"?
How small a gear can be finished by "shaving"?

What About Cost?

How many different gear sizes and types can be finished on one machine?
When should a rack or a rotary machine be used?
What tool life can be expected?
What does it cost to shave gears?

How Do You Use It?

How do you set up to shave different gear types?
What controls gear accuracy in "gear-shaving"?
What machine type should be used for any given class of gears?
How does it affect gear design?
How does the use of "gear-shaving" affect preliminary gear cutting operations?

What About Curve Shaving?

When should "curve shaving" be used?
When should "curve shaving" not be used?

These and numerous other questions are answered in a new booklet just made available by Gear Production Headquarters. Write for a copy on your company letterhead. Ask for Manual No. GF-43.

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS ROAD . . . DETROIT, U. S. A.

BUY U.S. BONDS STAMPS

LOOK OUT FOR "Bugs" THAT EAT STEEL

With everyone clamoring for steel, it's most disheartening to learn that a lowly sulphate reducing bacteria is consuming large quantities of industrial water cooling pipe.

It was hard for us to believe, too, but bacteriologists proved it to our satisfaction when they took sample water pipes and photomagnified one of these little "sulphur bugs" by fifty thousand diameters.

If you are having trouble with some "unexplainable corrosion" watch for:

1. Free sulphur or sulphides on pipe sample even though water shows no signs of these.
2. Odor of H_2S in the exhaust cooling water.
3. H_2S when HCl is added to a sample of the corroded metal.
4. Progressively worse corrosion as you proceed farther from the inlet end.
5. Acceleration of corrosion rate.

These "bugs" are especially prevalent where water is taken from a well or stagnant pond. Chlorinate the water and you will kill the "bugs" and save many tons of badly needed steel. The Timken Roller Bearing Company, Canton, Ohio. Steel and Tube Division.

TIMKEN

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ALLOY STEELS

Samples of pipe attacked by "sulphur bugs".

No, the photographer hasn't photographed his thumb. This is the portrait of a "sulphur bug" magnified 50,000 diameters.